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EARLY USE OF LAKE SUPERIOR ORE.

The Bulletin of the American Iron & Steel Association recently published a communication from Jacob Reese, of Philadelphia, which carries one back to the very beginning of the Lake Superior iron industry. This communication was as follows:

Sir:—I am surprised to read in the Bulletin, which is generally reliable, that "it was in 1872 that Lake Champlain ores were first used for fettling at Pittsburg." I sold more than 10,000 tons of Champlain iron ore for fettling in Pittsburg in 1856 and 1857, and it was in use in Pittsburg many years prior to my sales. In 1856 I bought from the Cleveland Iron Mining Co., the first cargo of 800 tons of Lake Superior iron ore that they had brought to Cleveland. I shipped the ore to Pittsburg and sold it for fettling, and from 1856 to 1860 I sold over 50,000 tons of that ore for that purpose. I bought the first two cargoes mined and brought down from Lake Superior, and I think that I am in the prime of life, although more than 38,000,000 tons were mined and shipped in 1906. I was one of the men who promoted the first use of Lake Superior iron ore in fettling and in the blast furnace, and although the millionaires who have been developed with the ore have forgotten me I still watch the development of this immense business with great interest.

JACOB REESE.

Jacob Reese is deserving of a distinct and honored place in the history of the American iron trade for he was a prophet crying in the wilderness. His first order was given to the Cleveland Iron Mining Co. in 1855 and not in 1856 as he relates. It was the first real order that the Cleveland Iron Mining Co. received after the canal opened.

The Sault Ste. Marie canal was opened in 1855 and the Cleveland Iron

Mining Co. shipped during that year 1,449 tons, which was the total shipment of the range, the Jackson Iron Co. not being prepared to ship any at all that year. The first cargo of iron ore carried through the canal after it was opened was in the brig Columbia, consisting of 132 tons. The Columbia was followed by the schooner George Worthington three days later with 322 tons, and by the propeller General Taylor with 50 tons. This ore was dumped on Crawford & Price's dock, Cleveland, where it was shortly thereafter seen by Jacob Reese. He placed an order with the company for some of the ore at once. His first order reads:

"Messrs. Hewitt & Tuttle: Please deliver to E. N. Parks & Co., thirty-five tons iron ore (Lake Superior).

Jacob Reese.

Cleveland, Sept. 20, 1855."

W. J. Gordon, president of the Cleveland Iron Mining Co., had a few days previously delivered 117 tons of this ore to W. F. Cary for experimental use in the Orizaba Iron Works at New Castle, Pa. A few days later F. K. Beshon, of the Orizaba Iron Works, wrote to Mr. Cary saying:

"I have given the Lake Superior ore a fair trial, but am sorry to say we had to abandon its use for the purpose intended."

Jacob Reese had perfect confidence in Lake Superior ore from the beginning and Mr. Gordon wrote to him at once and asked him to look into the New Castle experiment. In fact, Reese was a tower of strength to the original mining companies, who were beset on all sides by persons who doubted whether the mines which they had exploited at so much cost were capable of producing a merchantable ore. Mr. Reese's reply was quite interesting and was as follows:

"Pittsburg, Oct. 4, 1855.

W. J. Gordon,

Dear Sir:—Yours of the 25th at

hand and in reply would say I have 25 tons of Lake Superior ore coming here for the purpose of making a thorough trial of it as a fixing for the furnace, and therefore cannot go to New Castle at present as I desire to personally attend to the trial. Am not surprised to learn that they did not use it to advantage in New Castle. Ordinarily in fixing the ore is placed in the bottom of the furnace and subjected to sufficient heat to melt it. The furnace is then allowed to cool so that the ore becomes semi-liquid and in this pasty state it is removed from the bottom to the sides of the furnace, where it remains as a protector of the chills or air plates of the furnace. The Lake Superior ore in the block or quarry form is the most refractory ore that I have ever seen. It cannot be melted in our boiling furnace. However, when it is reduced by stamping or otherwise so that it is susceptible of being thoroughly penetrated by the atmosphere, it melts at a very low temperature, and when it becomes solid again it is as refractory as ever. One fixing thus put in will last as long as three fixings of Lake Champlain ore. I have also taken it in its rough form and piled it in and around the furnace as compact as possible and melted a small quantity of Lake Superior ore and daubed up the crevices. A fixing of this kind has lasted three or four days, whereas with the Lake Champlain ore the operation has to be renewed every twenty-four hours. I make these remarks, thinking it probable that they may be of some use to you.

P. S.—Have just seen a boiler from Sharon who says that it is the best fixing that he has ever seen and when properly put up will last a week."

On Oct. 22, 1855, he gave his second order to the Cleveland Iron Mining Co., as follows:

"I shall need from 400 to 500 tons of Lake Superior ore this fall. You

will please retain that amount for my order. Would like to have some of it at your most early convenience. Let me have some of the new kind if pos-

sible. Parties that have tried it here without an exception pronounce it superior. I would like to have the refusal of 1,000 tons this fall."

Vessel Losses and Accidents During 1906.

During 1906 forty-seven vessels with a carrying capacity of 58,165 gross tons and valued at \$976,000.00 were total losses on the great lakes. The monetary loss was low in comparison with former years, owing to the fact that the wrecked vessels were nearly all small. The most valuable was the Grecian which foundered in Lake Huron. She was the only steel vessel of American build that was lost. The year's disasters opened with the burning of the passenger steamer Atlanta in Lake Michigan very early in the season. Canadian owners suffered heavily, losing eight steamers, of which the most valuable was the Monarch which went to pieces off Isle Royale. The famous old steamer Gordon Campbell also passed out of existence by grounding on Michipicoten Island, and then taking fire. Her identity was lost to many under the name of Strathmore. Twenty-two of the vessels lost were steamers and twenty-five were schooners. Fire claimed nine of the wrecks, foundering fifteen, stranding seventeen and collisions six. Probably there should be added to the list the steamer H. B. Tuttle and the barge City of Toledo, both of which were sunk. However, H. W. Baker, the Detroit wrecker, has raised both of them, but whether they will be worth restoring to commission remains to be seen. Probably there should be taken from the list the Checotah, which foundered in Lake Huron. This schooner has been raised and purchased by the Edward Gillen Dock & Construction Co. The accompanying table gives the names of the vessels totally destroyed, with their capacities and value, the cause of the accident and the place.

LAKE WRECKS, 1906.

Jan. 15—Str. Hattie, owned by John Stevenson, Detroit; wholly burned.
Jan. 17—Car ferry Ann Arbor No. 1, owned by Ann Arbor Railroad & Steamship Line, Toledo, O.; collision in fog; 12-ft. hole in port bow of vessel.
Jan. 17—Str. Hennepin, owned by Lake Shore Stone Co., Milwaukee, Wis.; collision in fog; damage cost about \$100.
Jan. 25—Car ferry Pere Marquette No. 17, owned by Pere Marquette Steamship Co., Milwaukee, Wis.; broke her steering gear.
March 12—Str. C. H. Little, owned by C. H. Little, Detroit; struck rock; dozen or more new planks were required; in dry dock at Detroit.
March 18—Str. Atlanta, owned by Goodrich Transportation Co., Chicago; burned, total loss.
April 13—Str. D. M. Clemson, owned by Provident Steamship Co., Duluth, Minn.; ran aground; released in several hours.
April 16—Str. Umbria, owned by W. A. Hawgood & Co., Cleveland; ran on rocks; 18 plates and 62 floor frames had to be removed; in dry dock three weeks.
April 16—Str. Wm. A. Paine, owned by Hutchinson & Co., Cleveland; broke screw buckets off her wheel while bucking ice in Sault river; repaired.
April 16—Str. Eugene Zimmerman, owned by Toledo Steamship Co., Toledo, O.; collision with steamer Saxona.

April 16—Str. Saxona, owned by G. A. Tomlinson, Duluth, Minn.; collision with steamer Eugene Zimmerman.
April 17—Str. Widlar, owned by W. H. Becker, Cleveland; ran aground at Point Aux Pins; released on April 19, after lightering 5,000 bus. of barley.
April 19—Str. Frank C. Ball, owned by G. A. Tomlinson, Duluth; stranded on rocks, forward compartment leaked; released April 20.
April 20—Str. Simon J. Murphy, owned by Pittsburg Steamship Co., Cleveland; struck an obstruction in Sault river; starboard tanks 3 and 4 leaked; released April 21; 17 damaged plates; dry docked at Lorain.
April 20—Str. Donnacona, owned by R. O. & A. B. McKay, Hamilton, Ont.; stranded, but released without injury April 22.
April 22—Str. Mahetia, owned by Pittsburg Steamship Co., Cleveland; stranded on Round Island.

Lawrence & Chicago Steam Navigation Co., Toronto, Ont.; broke steering gear; steel plates badly damaged and rudder and shoe lost; put in dry dock at Collingwood.

April 25—Str. Robert Wallace, owned by Great Lakes & St. Lawrence Transportation Co., Chicago; stranded; leaked slightly, but cargo was not injured; released April 26.

April 26—Str. Starrucca, owned by Union Steamboat Line, Buffalo; ran on reef; large hole stove in bow, causing 25 plates to be taken off; placed in dry dock; cost of damage about \$20,000.

April 27—Str. H. B. Hawgood, owned by Henry A. Hawgood, Cleveland; grounded, but released on April 28 uninjured.

April 27—Str. Chattanooga, owned by Cleveland-Cliffs Iron Co., Cleveland; grounded at Lime Kiln Crossing.

April 27—Sch. Eliza Day, owned by Charles S. Carlson, Racine, Wis.; stranded, but released April 29, uninjured.

April 28—Str. Wm. Chisholm, owned by the Minch and Nicholas Transit Companies, Cleveland; cylinder head broke.

April 28—Str. D. M. Whitney, owned by Gilchrist Transportation Co., Cleveland; stranded; wheel chains parted.

April 28—Str. John Sherwin, owned by the Gilchrist Transportation Co., Cleveland; collision with Michigan Central bridge at Bay City; placed in dry dock; four plates broken

VESSELS TOTALLY LOST DURING 1906.

Name of Boat. Steamer.	Cause.	Where Lost.	Capacity, Gross tons.	Value.
Argonaut	Fire	Lake Huron	1,600	\$18,000
Atlanta	Fire	Lake Michigan	1,500	70,000
City of Concord	Foundered	Lake Erie	350	5,000
Conemaugh	Stranded	Lake Erie	2,000	30,000
Erin	Collision	St. Clair River	800	16,000
Erindale	Fire			
Fiske, James Jr.	Fire	St. Clair River	1,300	25,000
Golspie	Stranded	Lake Superior	1,200	20,000
Gov. Smith	Collision	Lake Huron	2,000	50,000
Grecian	Foundered	Thunder Bay	3,000	120,000
Hickox	Fire	Lake Ontario	400	6,000
Hill, C. B.	Stranded	Lake Erie	2,000	25,000
Mills, N.	Collision	St. Clair River	500	8,000
Monarch	Stranded	Lake Superior	2,000	85,000
New Orleans	Collision	Lake Huron	2,000	45,000
Nicol, John M.	Stranded	Lake Michigan	2,300	35,000
Packard, C. B.	Foundered	Lake Erie	1,000	30,000
Panama	Stranded	Lake Superior	2,700	45,000
Pauly, J. H.	Fire	St. Clair River	400	9,000
Resolute	Foundered	Lake Ontario	600	12,000
Strathmore	Fire	Lake Superior	1,600	17,500
Theano	Foundered	Lake Superior	2,600	80,000
Schooners.				
Aleria	Foundered	Lake Erie	3,800	40,000
Armenia	Foundered	Lake Erie	3,800	40,000
Bennett	Collision	Green Bay	...	7,000
Case	Foundered	Lake Erie	266	...
Checotah	Foundered	Lake Huron	1,300	9,000
Comstock, J. B.	Stranded	Lake Huron	700	6,500
Crosthwaite, W. S.	Collision	Lake Erie	1,300	17,000
Dall, Margaret	Stranded	Lake Michigan	149	2,000
Dowd, Reuben	Stranded	Lake Ontario	700	3,500
Elgin	Foundered	Lake Superior
Foster, S. H.	Stranded	Lake Superior	1,300	8,000
Grandy, Wm.	Fire	Lake Erie	500	3,000
Medora, Ada	Stranded	Lake Superior	600	4,000
Negaunee	Stranded	Lake Erie	1,000	6,000
Pasadena	Stranded	Lake Superior	2,500	30,000
Potter, Agnes	Fire	Lake Erie	500	2,500
Queen of the Lakes	Foundered	Lake Ontario	500	5,000
Richards, May	Stranded	Lake Erie	1,000	6,000
Smith, A.	Stranded	Lake Huron	1,000	8,000
Vienna	Foundered	Lake Huron	300	1,000
Wawanosh	Stranded	Lake Michigan
Wayne	Stranded	Lake Superior	1,300	10,000
West Side	Foundered	Lake Huron	600	3,500
Wilcox, M. I.	Foundered	Lake Erie	700	2,500
Wilson, Mabel	Foundered	Lake Erie	2,500	10,000

April 21—Bge. Bombay, owned by Boutell Steel Barge Co., Bay City, Mich.; ran aground at Lime Kiln Crossing; released same day.

April 22—Str. Clyde, owned by Tonawanda Iron & Steel Co., North Tonawanda, N. Y.; stranded on Round Island; released April 23, uninjured.

April 23—Str. J. T. Hutchinson, owned by Hutchinson & Co., Cleveland; struck at the dyke; temporarily repaired to finish trip; later in dry dock two weeks.

April 23—Bge. Krupp, owned by Pittsburg Steamship Co., Cleveland; stranded at Lime Kiln Crossing; released April 24, uninjured.

April 23—Tug Pilot; sunk by explosion of acetylene gas buoy in ship channel.

April 24—Str. John Stanton, owned by Hutchinson & Co., Cleveland; ran aground; released April 25, uninjured.

April 24—Str. King, owned by M. Sicken, Marine City, Mich.; grounded, but was released later in same day, uninjured.

April 25—Str. Iroquois, owned by St.

and four had to be rerolled; left dry dock May 6.

April 28—Sch. Ann Marie, owned by D. Gillies, Carleton Place, Ont., stranded.

April 29—Str. W. D. Rees, owned by Wilson Transit Co., Cleveland; stranded on Poe's reef; placed in dry dock May 7.

April 30—Str. Sanilac, owned by George H. Flood, Chicago, Ill.; machinery disabled; repaired.

May 1—Str. Viking, owned by Gilchrist Transportation Co.; stranded.

May 1—Sch. Fearless, owned by H. Williamson, Racine, Wis.; ran ashore, but released few hours later.

May 2—Str. F. W. Hart, owned by Gilchrist Transportation Co., Cleveland; forward end of boat badly damaged; air compressors put aboard and released May 5; docked at South Chicago for repairs.

May 2—Str. Wm. G. Mather, owned by Cleveland-Cliffs Iron Co., Cleveland; collision with steamer Midland Queen; damaged on

port side, five plates having to be removed; held at Ecorse several days for repairs.

May 2—Str. Wiehe, owned by Hines Lumber Co., Chicago; stranded, but released May 4, uninjured.

May 2—Str. Midland Queen, owned by Midland Navigation Co., Midland, Ont.; collision with steamer Wm. G. Mather; about 14 plates were damaged and taken off; not docked, damage being above water line; repaired at Wyandotte.

May 12—Str. Pilgrim, owned by Oscoda & Cleveland Trans. Co., St. Clair, Mich.; ran on rocks.

May 12—Car ferry Pere Marquette No. 15, owned by Graham & Morton Line, Chicago; stranded in fog; released May 13, uninjured.

May 13—Sch. Ellen Williams, owned by O. Swanson, LaGrange, Ill.; struck an obstruction near Bois Blanc Island and sank; raised and taken to dry dock May 21; badly injured.

May 14—Str. Huronic, owned by Northern Navigation Co., Collingwood, Ont.; struck just before entering Canadian canal; several plates on starboard side damaged; released May 15 and placed in dry dock at Detroit on May 18.

May 14—Sch. Armenia, owned by West Division Steamship Co., Chicago; foundered; total loss.

May 14—Sch. Algeria, owned by Sidney Scott, Mt. Clemens, Mich.; foundered; total loss; cargo valued at \$11,000; wreck bought by Walter Metcalf, Cleveland, O.

May 15—Str. George Sturges, owned by J. P. Goodman, Chicago; collision with steamer W. E. Reis; dry docked at Sturgeon Bay.

May 16—Str. Lewiston, owned by John Green, Buffalo; ran ashore; released and docked.

May 16—Str. Simon J. Murphy, owned by Pittsburg Steamship Co., Cleveland; collision with steamer Roebbing; hole in stern; repaired.

May 19—Str. Socapa, owned by G. A. Tomlinson, Duluth, Minn.; stranded, but released May 20, uninjured.

May 19—Sch. J. J. Barlum, owned by Algoma Central Steamship Line, Sault Ste. Marie, Ont.; taken to Sault Ste. Marie May 21, after making temporary repairs.

May 21—Str. Simon Langell, owned by Comstock & Sinclair, Duluth, Minn.; main shaft broke; placed in dry dock May 23.

May 21—Str. Falcon, owned by Cleveland-Cliffs Iron Co.; machinery disabled; repaired.

May 22—Str. Briton, owned by Pittsburg Steamship Co., Cleveland; grounded on a sand bar; released May 25, uninjured.

May 22—Str. Axon, owned by Ogdensburg Coal & Towing Co., Ogdensburg, N. Y.; broke steering gear; repaired.

May 22—Str. Pellatt, owned by Canadian Lake & Ocean Navigation Co., Toronto, Ont.; grounded; cargo lightered.

May 24—Str. John Duncan, owned by H. J. Pauly, Milwaukee, Wis.; collision with steamer Wisconsin; bow smashed and grounded; released May 26, not seriously injured; docked June 2; cost of damage about \$500.

May 23—Tug H. L. Chamberlain, owned by Standard Contracting Co., Cleveland; broke her shaft; placed in floating dry dock and repaired.

May 24—Str. Charles Neff, owned by Charles S. Neff, Milwaukee, Wis.; stranded; wheel chains parted; started out May 27, after being temporarily repaired.

May 24—Str. Wiehe, owned by Hines Lumber Co., Chicago; crashed into Cowper lumber docks; smashed her bow.

May 24—Str. Charles Beatty, owned by Volunteer Transit Co., Cleveland; ran aground.

May 25—Str. Uranus, owned by Gilchrist Transportation Co., Cleveland; ran ashore; released May 28, after lightering cargo; considerably damaged; 23 plates removed, 16 being replaced with new ones; repairs begun on her June 9.

May 26—Str. Howard L. Shaw, owned by Pittsburg Steamship Co., Cleveland; collision with steamer Coralia and tow and barge 133; several plates and frames broken; after temporary repairs were made she proceeded on May 27; placed in dry dock June 2.

May 26—Bge. 133, owned by Pittsburg Steamship Co., Cleveland; collision with steamer Howard L. Shaw and steamer Coralia and tow; several plates and frames broken; at yard of Toledo Ship Building Co. on June 3.

May 26—Str. Coralia, owned by Pittsburg Steamship Co., Cleveland; collision with steamer Howard L. Shaw and tow and barge Maia; not badly damaged.

May 26—Bge. Maia, owned by Pittsburg Steamship Co., Cleveland; collision with steamer Shaw and tow and steamer Coralia; not badly damaged.

May 26—Str. Ramapo, owned by Union Steamboat Line, Buffalo; chain broke; lost anchor.

May 27—Str. Frank H. Peavey, owned by Peavey Steamship Co., Duluth, Minn.; ground-

ed; steering gear disabled; released May 30, after lightering.

May 27—Str. Midland Queen, owned by Midland Navigation Co., Midland, Ont.; ran ashore in storm, but was released later in day, uninjured.

May 27—Str. Sinaloa, owned by G. A. Tomlinson, Duluth, Minn.; grounded.

May 27—Bge. Montezuma, owned by James Davidson, Bay City, Mich.; stranded.

May 28—Sch. Mabel Wilson, owned by P. J. Ralph & Co., Detroit, Mich.; lost in storm off Cleveland; total loss.

May 29—Str. Northern Wave, owned by Mutual Transit Co., Buffalo; ran into dock and damaged rudder.

May 29—Str. Mary A. McGregor, owned by Potter, Teare & Co., Cleveland; broke wheel by running into dock.

May 31—Str. Erin, owned by J. & T. Conlon, Thorold, Ont.; sunk in collision with steamer John B. Cowle; total loss.

May 31—Str. John B. Cowle, owned by Cowle Transit Co., Cleveland; collision with steamer Erin; repairs on her completed June 14.

June 1—Tug Ames, owned by Wisconsin & Michigan Railway, Chicago; ran into bridge at Sturgeon Bay.

June 2—Str. Cumberland, owned by Gilchrist Transportation Co., Cleveland; collided with bridge; sank; later raised and put in dry dock.

June 5—Str. Roman, owned by Pittsburg Steamship Co., Cleveland; went ashore in foggy weather; two tanks leaked; released June 6, docked June 11, left dry dock June 13.

June 5—Str. Bulgaria, owned by Corrigan-McKinney Co., Cleveland; went ashore in foggy weather; decks forced up, forefoot gone and bottom badly damaged; abandoned as constructive total loss by underwriters; wreck purchased by Thomas Isbell, Sturgeon Bay, Wis.; released Aug. 13, but grounded again on the 14th while being brought in; released Aug. 15 and docked Sept. 11.

June 5—Str. Rhoda Stewart, owned by L. P. & J. A. Smith, Cleveland; became disabled.

June 7—Str. Faustin, owned by J. M. Shackett, Marine City, Mich.; grounded.

June 7—Bge. Fulton, owned by Capt. J. Glenn, Detroit; grounded.

June 7—Str. Grecian, owned by Pittsburg Steamship Co., Cleveland; struck a rock; tank top broken, later sank; raised, but sank again while en route to dry dock at Detroit on June 16; total loss.

June 8—Str. John Duncan, owned by H. J. Pauly, Milwaukee, Wis.; collision with steamer Lehigh; sank in shallow water in port; floated Sept. 6.

June 8—Str. Lehigh, owned by Anchor Line, Buffalo; collision with steamer John Duncan; not injured.

June 9—Sch. Three Brothers, owned by Julian Porter, Lorain, O.; dismasted in storm; placed in dry dock for repairs.

June 9—Str. James E. Davidson, owned by G. A. Tomlinson, Duluth, Minn.; grounded; steering gear broke; released June 10.

June 11—Str. Juliet, owned by Pittsburg Steamship Co., Cleveland; collision with a scow; temporarily repaired; scow was sunk.

June 13—Str. Philip Minch, owned by Kinsman Transit Co., Cleveland; struck crib at Ashtabula; not injured.

June 15—Str. Lizzie A. Law, owned by Hines Lumber Co., Chicago; struck by a steamer; slightly injured.

June 16—Str. B. Lyman Smith, owned by United States Transportation Co., Cleveland; struck a rock.

June 16—Str. Sultana, owned by G. A. Tomlinson, Duluth, Minn.; stranded.

June 17—Str. Manchester, owned by Interocean Transportation Co., Milwaukee, Wis.; collision with steamer Steel King; bow badly broken; extensively repaired; left dry dock July 8.

June 17—Str. Steel King, owned by Gilchrist Transportation Co., Cleveland; collision with steamer Manchester; badly damaged; released June 21 and temporarily repaired; placed in dry dock June 25.

June 17—Str. Saturn, owned by Gilchrist Transportation Co., Cleveland; collision with schooner Ontario; not damaged.

June 17—Sch. Ontario; collision with steamer Saturn; headgear carried away by the Saturn; taken to Port Huron for repairs.

June 18—Str. Wawatom, owned by Pittsburg Steamship Co., Cleveland; collision with steamer George J. Gould; three plates damaged; repaired in two or three days.

June 18—Str. George J. Gould, owned by Lake Erie Transportation Co., Toledo, O.; collision with steamer Wawatom.

June 18—Str. Merida, owned by Gilchrist Transportation Co., Cleveland; collision with schooner Antrim; badly damaged; temporarily repaired.

June 18—Sch. Antrim, owned by Gilchrist Transportation Co., Cleveland; collision with steamer Merida; badly damaged; temporarily repaired.

June 18—Str. F. H. Prince, owned by Rutland Transit Co., Ogdensburg, N. Y.; collision with schooner Mitchell.

June 18—Sch. Oliver Mitchell, owned by James Reid, Sarnia, Ont.; collision with steamer Prince.

June 18—Str. Carrie Ryerson, owned by John H. Hill, Chicago; collision with steamer Georgia; badly damaged; sank.

June 18—Str. Angeline, owned by Cleveland-Cliffs Iron Co., Cleveland; ran ashore in fog; not injured; released later in day.

June 19—Str. America; ran aground; released same day.

June 19—Bge. Manda, owned by Pittsburg Steamship Co., Cleveland; collision with an unknown steamer; released same day, but stranded again on June 24; released same day, not damaged.

June 20—Str. Gladstone, owned by M. A. Bradley, Cleveland; went ashore in fog; released June 21.

June 21—Str. G. Watson French, owned by C. W. Elphicke & Co., Chicago; grounded; released June 22.

June 21—Str. Henry B. Smith, owned by W. A. Hawgood & Co., Cleveland; grounded; released June 22.

June 22—Str. Curtiss, owned by Tonawanda Iron & Steel Co., North Tonawanda, N. Y.; ran on rocks; hull badly injured; released June 24.

June 24—Str. Oceanica, owned by Tonawanda Iron & Steel Co., North Tonawanda, N. Y.; ran on rocks; broke propeller wheel.

June 24—Bge. Holland, owned by Tonawanda Iron & Steel Co., North Tonawanda, N. Y.; in tow of steamer Oceanica.

June 24—Str. Robert Holland, owned by Shannon & Garey, Saginaw, Mich.; stranded; released June 28.

June 25—Str. Amasa Stone, owned by Pickands, Maher & Co., Cleveland; grounded in fog; released June 26; not injured.

June 25—Str. W. R. Stafford, owned by Hope Trans. Co., Detroit; stranded.

June 25—Bge. Edward McWilliams, owned by Hope Trans. Co., Detroit; stranded.

June 25—Str. Veronica, owned by Tonawanda Iron & Steel Co., North Tonawanda, N. Y.; went on rock; released June 27; went to Buffalo for repairs.

June 27—Sch. Wm. Brake, owned by Capt. Peter LaCroix, Port Huron, Mich.; sprung a leak and sank; raised July 13 and repaired.

June 28—Tug Alfred W., owned by Duluth & Lake Superior Dredging Co., Duluth; struck a rock; sank; total loss.

June 28—Str. Runnels, owned by Spence Bros., Cleveland; collision with barge Ralston.

June 28—Bge. Ralston, owned by Capt. Peter LaCroix, Port Huron, Mich.; collision with steamer Runnels.

June 29—Str. Alfred Mitchell, owned by Lakeside Steamship Co., Duluth; grounded.

June 29—Str. New Orleans, owned by Capt. J. B. Hall, Buffalo, N. Y.; collision with steamer Lynn; sunk; total loss.

June 29—Str. Lynn, owned by Pittsburg Steamship Co., Cleveland; collision with steamer New Orleans; repairs completed July 10.

July 2—Str. C. W. Elphicke, owned by Gilchrist Transportation Co., Cleveland; stripped of her stack and masts while unloading at B. & O. hoists at Lorain.

July 3—Str. Wm. P. Snyder, owned by Shenango Steamship Co., Cleveland; engine ran through itself; went to Detroit for repairs.

July 3—Str. City of Naples, owned by Gilchrist Transportation Co., Cleveland; fire; not greatly damaged.

July 8—Str. Wallula, owned by Gilchrist Transportation Co., Cleveland; ran aground at Sandusky; released July 10; cargo lightered; not injured.

July 9—Str. Henry Houghton, owned by S. Houghton, Detroit; collision with steamer Frank Peavey; beached in sinking condition; docked July 9.

July 9—Str. Midland King, owned by Midland Navigation Co., Midland, Ont.; collision with steamer Northern Wave; not injured.

July 9—Str. Northern Wave, owned by Mutual Transit Co., Buffalo; collision with steamer Midland King; broke fender strake and cracked collision bulkhead and several plates damaged; damage being above water line she went on her trip.

July 11—Str. Kalkaska, owned by J. A. Callick & Co., Chicago; broke shaft.

July 11—Str. Anna C. Minch, owned by Kinsman Transit Co., Cleveland; stranded in Sault river; lost shoe and twisted rudder; released and went on; arrived at Lorain for re-

pairs on July 15 and was placed in dry dock on the 18th; left dry dock July 29.

July 13—Str. Miami, owned by Hugh R. Havey, Detroit; disabled; dry docked.

July 13—Str. Oscar Flint, owned by Comstock & Sinclair, Duluth; machinery became disabled.

July 15—Tug Shaun Rhue, owned by Dunbar & Sullivan Wrecking Co., Buffalo; capsized; large hole in side of boat.

July 18—Str. Sonora, owned by G. A. Tomlinson, Duluth; stranded at Round Island; released July 19.

July 18—Bge. Santiago, owned by Pickands, Mather & Co., Cleveland; ran on bank at Lime Kiln Crossing; released July 19.

July 19—Str. Frank H. Goodyear, owned by Mitchell & Co., Cleveland; lost anchor in old river bed, Cleveland.

July 19—Str. James P. Walsh, owned by C. O. Jenkins, Cleveland; collision with steamer Muncy; broke railing and bulwarks; stanchions damaged also; estimated cost of damage about \$500.

July 19—Str. Muncy, owned by Erie & Western Trans. Co., Buffalo; collision with steamer James P. Walsh; not injured.

July 21—Str. Nipigon, owned by Marine Transportation Co., Ogdensburg, N. Y.; broke locks 15 and 16 at Port Colborne; delayed passage of all boats for one day; docked for repairs and was out of commission for about one week.

July 22—Sch. Georger, owned by Gilchrist Transportation Co., Cleveland; collision with barge Troy; considerably damaged above water line, but proceeded on her way.

July 22—Bge. Troy, owned by R. Folkerts, Marine City, Mich.; collision with schooner Georger; considerably damaged above water line, but went on.

July 22—Sch. Case, owned by Black Diamond Trans. Co., Detroit; sprang a leak in heavy sea; sank; total loss.

July 23—Str. Henry Sill, owned by Gilchrist Transportation Co., Cleveland; collided with steamer Mariska; 28 plates damaged; put in dry dock; repairs completed Aug. 10.

July 23—Str. Mariska, owned by Pittsburg Steamship Co., Cleveland; collision with steamer Henry Sill; large hole in bow; temporarily repaired on the 24th; later out of commission a week being repaired.

July 24—Sch. James G. Blaine, owned by W. K. Fullum, Buffalo; went ashore.

July 25—Tug Wm. B. Castle, owned by Wm. Schaefer, St. Clair; struck by steamer Robert Holland; sank; total loss.

July 25—Str. Robert Holland, owned by Shannon & Garey, Saginaw, Mich.; struck tug Wm. B. Castle; slightly damaged.

July 26—Str. C. W. Elphicke, owned by Gilchrist Transportation Co., Cleveland; struck breakwater at Cleveland; sank partly just outside breakwater at Cleveland; released Aug. 10; placed in dry dock Aug. 23; left dock Oct. 2.

July 27—Str. Charles Weston, owned by Tonawanda Transit Co., North Tonawanda, N. Y.; went ashore; released July 29; placed in dry dock Aug. 8.

July 27—Str. Saturn, owned by Gilchrist Transportation Co., Cleveland; struck wreck of tug Castle and went to bottom of Blackwell canal; hole in forward compartment.

July 28—Str. Valentine; struck a log and crushed large hole in bow, causing her to sink; one life lost.

July 28—Str. Major, owned by Mitchell & Co., Cleveland; ran ashore on Madeline Island, Lake Superior; released July 29, uninjured.

July 29—Str. L. C. Smith, owned by United States Transportation Co., Cleveland; struck on starboard side just after leaving narrow channel at Sailor's Encampment; had leak in cargo hold; lighted 1,000 tons of ore and left on July 31 with temporary repairs; later two weeks in dry dock; 18 damaged plates.

July 29—Bge. Chippewa, owned by W. S. Brainard, Toledo, O.; collision with unknown Gilchrist steamer; released July 31; temporarily repaired.

July 30—Str. Peter White, owned by Cleveland-Cliffs Iron Co., Cleveland; got stuck on bottom of river at Cleveland.

July 31—Tug Ben Campbell, owned by Great Lakes Towing Co.; struck by a scow while tied up at dock at Cleveland and went to bottom.

Aug. 1—Str. Anna C. Minch, owned by Kinsman Transit Co., Cleveland; grounded at Sandusky; released Aug. 4; not damaged.

Aug. 1—Str. City of Toledo, owned by White Star Line, Detroit; high pressure cylinder cracked; repaired; out of commission about a week.

Aug. 2—Str. Joliet, owned by Pittsburg Steamship Co., Cleveland; stranded on west bank of Lime Kiln Crossing.

Aug. 2—Str. Sacramento, owned by James Davidson, Bay City, Mich.; stranded in low water at Buffalo; released within a few hours after lightering.

Aug. 2—Str. Sherwin, owned by Gilchrist Transportation Co., Cleveland; collision with steamer Sahara at Masaba ore docks at Duluth; anchor ran through the Sahara.

Aug. 2—Str. Sahara, owned by G. A. Tomlinson, Duluth; collision with steamer Sherwin at Masaba ore docks at Duluth; damaged bow plates.

Aug. 3—Pass. Str. Missouri, owned by Northern Michigan Transportation Co., Chicago; lost her rudder on Lake Michigan; towed from Potoskey to Chicago for repairs; out of commission one week.

Aug. 5—Str. John Harper, owned by Gilchrist Transportation Co., Cleveland; struck at Colchester light and was beached; lighted; bottom badly damaged; released Aug. 7, and sufficiently repaired to go on trip on the 8th.

Aug. 5—Str. Lewiston, owned by John Green, Buffalo; grounded at Amherstburg through breaking of steering gear; released Aug. 6, uninjured.

Aug. 5—Pass. Str. Greyhound, owned by White Star Line, Detroit; was blown hard aground on a shoal at the foot of Hickory Island; released Aug. 6.

Aug. 7—Str. James Davidson, owned by G. A. Tomlinson, Duluth; accident to her machinery on Lake Superior and towed to Duluth by steamer Socapa.

Aug. 8—Str. Alexandria, owned by Ontario & Quebec Navigation Co., Picton, Ont.; broke engine shaft while passing Ogdensburg; towed to Prescott for repairs.

Aug. 8—Str. Osceola, owned by Edward Hines Lumber Co., Chicago; broke her wheel while going into North Tonawanda with a lumber cargo.

Aug. 9—Pass. Str. Lucille, owned by Dora May Brower, Ashland, Wis.; water rushed into hold and extinguished all fires; sank in Lake Erie off Toledo; no passengers aboard.

Aug. 10—Str. Erindale, owned by Canadian parties; burned while at dock at Bowmanville; valued at \$14,000; insured for half; total loss.

Aug. 10—Str. Oregon, owned by J. A. Calbick, Chicago; sank in Menominee Canal; total loss.

Aug. 10—Str. J. H. Pauly, owned by C. W. Kotcher, Detroit; burned to water's edge near Marine City; vessel valued at \$10,000; insurance, \$4,000.

Aug. 11—Str. Troy, owned by Western Transit Co., Buffalo; ran into Interstate bridge at Duluth; bow stove in; badly damaged.

Aug. 12—Str. Joseph L. Hurd, owned by Leatham & Smith, Sturgeon Bay, Wis.; sprung a leak off Grosse Point, Lake Michigan, and sank.

Aug. 12—Str. Mueller, owned by Wm. Mueller Co., Chicago; ran out of channel in Erie Basin and went hard aground; cargo lighted and released Aug. 13.

Aug. 13—Str. Addie Wade, owned by James A. Lemere, Jacksonport, Mich.; engine went through itself near Sturgeon Bay, where she was towed for repairs.

Aug. 14—Str. Oscar Flint, owned by Comstock & Sinclair, Duluth; collision; went to dry dock for new stem and forefoot; left dry dock Aug. 21.

Aug. 15—Str. Pontiac, owned by Cleveland-Cliffs Iron Co., Cleveland; got log in her wheel in Ashtabula harbor, breaking several blades and bending her rudder; placed in dry dock same day.

Aug. 15—Str. Simon Langell, owned by Comstock & Sinclair, Duluth; collision with barge Chattanooga in Soo passage; bow and bulwarks damaged; also shaft bent; repaired at Detroit.

Aug. 15—Bge. Chattanooga, owned by Cleveland-Cliffs Iron Co., Cleveland; collision with steamer Simon Langell in Soo passage; not damaged.

Aug. 16—Str. America; collision with steamer Black at the Dyke; temporarily repaired.

Aug. 16—Str. Black, owned by Pittsburg Steamship Co., Cleveland; collision with steamer America at the Dyke; not badly damaged.

Aug. 17—Bge. M. H. Young, owned by Henry McMorran, Port Huron, Mich.; grounded near Kelley's Island; released Oct. 15.

Aug. 18—Str. Empire City, owned by Pittsburg Steamship Co., Cleveland; pipe burst near Conneaut and two firemen scalded to death; vessel not injured.

Aug. 18—Str. Saugatuck, owned by Chicago, Saugatuck & Douglas Trans. Co., Saugatuck, Mich.; ran into tug Bennett off Shumacker Point and sank it; not damaged.

Aug. 18—Tug Bennett, owned by Nau Tug Line, Green Bay, Wis.; collision with steamer Saugatuck off Shumacker Point; sunk; total loss.

Aug. 18—Tug Ottawa, owned by E. C. Dunbar, Detroit; blew out her cylinder head eighteen miles southeast of Thunder Bay Island.

Aug. 18—Str. J. H. Farwell, owned by W. H. Follette, Tonawanda, N. Y.; stranded on Waverly shoal, Buffalo harbor; released later in day after lightering part of her cargo.

Aug. 19—Str. Uranus, owned by Gilchrist Transportation Co., Cleveland; collision with steamer Governor Smith eight miles off Pointe Aux Barques, Lake Huron; badly damaged; temporarily repaired; placed in dry dock Sept. 1, left dry dock Sept. 21; received new stern and had 30 plates straightened.

Aug. 19—Str. Governor Smith, owned by Rutland Transit Co., Ogdensburg, N. Y.; collision with steamer Uranus, eight miles off Pointe Aux Barques, Lake Huron; sunk; value of boat estimated at \$60,000; total loss.

Aug. 21—Str. Frank Peavey, owned by Peavey Steamship Co., Duluth; ran on rocks at the head of Lake Superior, owing to thick smoke which hung over the upper lakes; released Aug. 23; 70 plates taken off; repairs completed; Sept. 14; steamer lost two trips.

Aug. 21—Sch. Hattie Hunt, owned by Capt. M. Mathison, Milwaukee, Wis.; was anchored off Grosse Point, having had her jibs blown away; towed to Chicago.

Aug. 21—Sch. Ford River, owned by Louis F. Drieske & Co., Chicago; struck Wells St. bridge at Chicago; damage done to bridge, but not boat.

Aug. 21—Str. George Stephenson, owned by Pittsburg Steamship Co., Cleveland; got towing cable in her wheel; was towed to Port Huron.

Aug. 22—Str. Wm. A. Rogers, owned by Pittsburg Steamship Co., Cleveland; ran ashore at Long Point, near Buffalo; released on Aug. 25, not injured.

Aug. 24—Str. Pasadena, owned by M. A. Bradley, Cleveland; grounded in the river near Racine; towed to dock at Milwaukee on the 25th.

Aug. 24—Str. Case, owned by Gilchrist Transportation Co., Cleveland; sank at Port Washington; raised on the 25th and towed to Milwaukee for repairs; placed in dry dock on the 27th.

Aug. 25—Bge. Homer, owned by A. J. Young, Marine City, Mich.; collided with north Lime Kiln Crossing lightship; lightship slightly damaged, but barge uninjured.

Aug. 26—Str. Illinois, owned by Northern Michigan Transportation Co., Chicago; beached near Charlevoix; released Aug. 28, uninjured.

Aug. 26—Str. City of Concord, owned by D. W. Mills, Cleveland; disabled by getting tow line in her wheel; total loss.

Aug. 26—Str. Argonaut, owned by D. W. Mills, Cleveland, in tow of steamer City of Concord; total loss.

Aug. 26—Sch. Reuben Dowd; wrecked on Lake Ontario; total loss.

Aug. 27—Str. Castle Rhodes, owned by Minneapolis, St. Paul & Buffalo Steamship Co., Buffalo; collision with schooner Buckeye State, near Port Huron.

Aug. 27—Str. Buckeye State, owned by J. L. Crosthwaite, Buffalo; collision with steamer Castle Rhodes near Port Huron; stern badly injured.

Aug. 27—Str. Tuttle, owned by C. E. Benham, Cleveland; became waterlogged while out in storm and tied up at old Lime Kiln dock at Lorain, where she sank.

Aug. 28—Str. Rhoda Stewart, owned by L. P. & J. A. Smith, Cleveland; badly crippled in storm on Lake Erie; engine pipe broke.

Aug. 28—Bge. Wm. Grandy, owned by L. P. & J. A. Smith Co., Cleveland; wrecked in storm on Lake Erie; total loss.

Aug. 28—Bge. Agnes Potter, owned by L. P. & J. A. Smith, Cleveland; ran aground in storm on Lake Erie and caught fire; totally destroyed.

Aug. 28—Str. C. A. Eddy, owned by Gilchrist Transportation Co., Cleveland; caught fire on Lake Huron; badly damaged; reached Cleveland Aug. 31; out of commission for rest of season.

Aug. 28—Str. Frontenac, owned by Cleveland-Cliffs Iron Co., Cleveland; damaged while navigating in heavy sea on Lake Superior; bulwarks were carried away and deckhouse damaged.

Aug. 29—Str. J. G. Sharples, owned by Great Lakes & St. Lawrence Transportation Co., Chicago; struck a rock in Waukegan Harbor; stove hole in bow of steamer causing it to sink; floated on the 31st; docked for repairs.

Aug. 29—Str. City of London, owned by R. J. Dunham, Chicago; lost propeller wheel on Lake Superior, off Manitow Island, and became wholly disabled; towed to port for repairs and was placed in dry dock.

Aug. 29—Str. Olympia, owned by Gilchrist Transportation Co., Cleveland; ran aground in Sandusky Harbor; released on the 30th.

Aug. 29—Sch. Fleetwing, owned by John Marks, Windsor, Ont.; was found leaking and abandoned in bay near Center Island.

Aug. 30—Str. George Stephenson, owned by Pittsburg Steamship Co., Cleveland; ran aground at Bar Point.

Sept. 1—Str. Wallula, owned by Gilchrist Transportation Co., Cleveland; became disabled

by breaking of her engine; about two miles from Milwaukee, and was towed to port.

Sept. 1—Str. Alcona, owned by John J. Boland & Co., Buffalo; struck a rock in Niagara river and placed in dry dock at Buffalo.

Sept. 1—Sch. Cavalier; struck Chantry Island reef while out in a storm; wrecked, probably total loss.

Sept. 2—Str. Linn, owned by Pittsburg Steamship Co., Cleveland; stranded at Bar Point; released herself Sept. 3.

Sept. 3—Str. D. Z. Norton, owned by W. C. Richardson, Cleveland; ran aground at Ashtabula; released Sept. 4.

Sept. 4—Tug Balize, owned by Charlton Lumber Co., North Tonawanda, N. Y.; sank at Little Detroit passage; floated Oct. 13.

Sept. 5—Bge. Marsala, owned by Pittsburg Steamship Co., Cleveland; ran aground at entrance to Ashtabula harbor; released after lightering; detained 14 hours.

Sept. 5—Bge. Maitland, owned by Franklin Transportation Co., Cleveland; ran aground inside of Ashtabula harbor.

Sept. 5—Str. Wm. G. Mather, owned by Cleveland-Cliffs Iron Co., Cleveland; steering gear became disabled while she was entering St. Clair river and she ran 20 ft. into the bank, but later released herself without injury.

Sept. 6—Str. Nelson Mills, owned by D. W. Mills, Cleveland; collision with steamer Milwaukee in Detroit river; two lives lost; total loss.

Sept. 6—Str. Milwaukee, owned by Western Transit Co., Buffalo; collision with steamer Nelson Mills in Detroit river; stem badly bent and forepeak filled with water; but she proceeded on trip.

Sept. 6—Sch. Wm. Crosthwaite, owned by Shannon & Garey, Saginaw, Mich.; collision with steamer Homer Warren off Kelley's Island; sank; total loss.

Sept. 6—Str. Homer Warren, owned by Shannon & Garey, Saginaw, Mich.; collision with steamer Wm. Crosthwaite off Kelley's Island; large hole stove in just below water line; temporarily patched up and went on her trip.

Sept. 7—Str. Sahara, owned by G. A. Tomlinson, Duluth; ran into breakwater at Conneaut; stern badly bent; placed in dry dock; left dry dock Sept. 12.

Sept. 9—Str. Perkins, owned by Pittsburg Steamship Co., Cleveland; machinery became disabled just after leaving Duluth; she was obliged to return to port when about 10 miles out and was repaired.

Sept. 10—Str. Falcon, owned by Cleveland-Cliffs Iron Co., Cleveland; ran ashore about three miles off Charlevoix, Lake Michigan, while navigating through dense smoke; released Sept. 11, uninjured.

Sept. 11—Str. Rosemount, owned by Montreal Transit Co., Montreal, Canada; ran on rocks near Detour lighthouse; released Sept. 14 and went on to the Soo; docked Sept. 26 for repairs; 17 plates damaged and repairs quite expensive.

Sept. 12—Bge. Manga, owned by Pittsburg Steamship Co., Cleveland; struck bridge at Lorain; damage amounted to about \$100.

Sept. 14—Str. R. A. Seymour, owned by F. A. Denmeth, Sheboygan, Wis.; picked up in disabled condition on Sturgeon Bay and taken to port for repairs.

Sept. 15—Sch. Peerless, owned by Chicago Trans. Co., Chicago, Ill.; wrecked at Epousette, near Racine, Wis.; released Sept. 20.

Sept. 15—Sch. Mary F. MacLachlan, owned by MacLachlan Trans. Co., Port Huron, Mich.; struck breakwater at fog signal station at Manitowoc while out in storm; big hole torn in her side; towed to dock, and later sank in the river; station badly damaged.

Sept. 15—Str. H. B. Tuttle, owned by C. E. Benham, Cleveland; sprang a leak near Cedar Point and was beached at Marblehead, Lake Erie; released and temporarily repaired on the 19th.

Sept. 15—Str. Tempest, owned by Grace Harbor Lumber Co., Detroit; stranded at Sault; leaked badly and had to be docked; released Sept. 17.

Sept. 16—Str. Crescent City, owned by Pittsburg Steamship Co., Cleveland; stranded in rain storm at Houghton Point.

Sept. 16—Bge. 133, owned by Pittsburg Steamship Co., Cleveland; in tow of steamer Crescent City.

Sept. 17—Str. C. B. Packard, owned by J. A. Calbick & Co., Chicago; struck wreck of schooner Armenia off Middle Ground, Lake Erie, and sank; total loss.

Sept. 18—Sch. Melrose, owned by Montreal Transportation Co., Montreal, Canada; stranded at the Soo; released after lightering 5,000 bushels of grain; temporarily repaired and proceeded on her journey.

Sept. 18—Str. Saxon, owned by Pittsburg Steamship Co., Cleveland; struck by the Amasa Stone in Soo river; stern slightly damaged; did not stop for repairs.

Sept. 19—Str. Uganda, owned by Edward Mehl, Erie, Pa.; struck bridge at Buffalo, blocking navigation; released, uninjured, on Sept. 20.

Sept. 19—Str. Atlantic; lost propeller wheel abreast of Port Hope, but proceeded to Harbor Beach, Mich., under canvas.

Sept. 20—Str. Turret Cape, owned by Canadian Lake & Ocean Navigation Co., Toronto, Ont.; went into dry dock this day at Lorain for repair to bottom plates which were damaged by steamer striking in the Welland Canal; left dry dock Sept. 26.

Sept. 20—Str. State of Ohio, owned by Detroit & Cleveland Navigation Co., Detroit; ran aground on Rattlesnake Island, Lake Erie; released Oct. 16; taken to Detroit for repairs.

Sept. 21—Ferry steamer Hiawatha, owned by Port Huron & Sarnia Ferry Co., Port Huron, Mich.; struck a pile below Port Huron and sank in shallow water; arrived at Lorain Sept. 29 and was put in dry dock after discharging cargo.

Sept. 21—Bge. Fritz, owned by Pittsburg Steamship Co., Cleveland; ran aground at the head of Stag Island; released Sept. 26.

Sept. 21—Str. Robert Fulton, owned by Pittsburg Steamship Co., Cleveland; stranded on Bar Point; released Sept. 22, uninjured.

Sept. 21—Bge. Nasmyth, owned by Pittsburg Steamship Co., Cleveland; stranded near Bar Point; released Sept. 22, uninjured.

Sept. 21—Bge. Jenny, owned by Pittsburg Steamship Co., Cleveland; stranded at Bar Point.

Sept. 23—Tug James A. Quinn, owned by Great Lakes Towing Co., Cleveland; broke steering gear outside of Lorain harbor and was towed in next morning.

Sept. 25—Tug Onida; struck by steamers Britannia and C. B. Hill which collided at Detroit and was nearly sunk; hole being torn in her hull; taken to shipyard at Detroit for repairs.

Sept. 26—Str. LaSalle, owned by Pittsburg Steamship Co., Cleveland; stranded near Sailors' Encampment, Soo, blocking the channel and delaying passing boats; considerable damage done to her bottom plating; released same day.

Sept. 26—Pass. Str. City of Windsor, owned by D. L. Sudbury, Canada; badly damaged by fire while lying at Owen Sound dock.

Sept. 26—Str. J. G. Brower, owned by United States Transportation Co., Cleveland; struck Hoover & Mason machine at Ashtabula; damaged machine so as to render it useless for about two weeks; steamer not injured.

Sept. 27—Str. Black Rock, owned by R. J. Dunham, Chicago; collision in Lake St. Clair with barge Pasadena; leaked badly, but went on trip.

Sept. 27—Bge. Pasadena, owned by M. A. Bradley, Cleveland; collision in Lake St. Clair with steamer Black Rock; upper works damaged, but she did not stop.

Sept. 27—Str. John Harper, owned by Gilchrist Transportation Co., Cleveland; ran aground near Sault Point; rudder disabled; released Sept. 28 and docked Oct. 3.

Sept. 28—Bge. Baroness, owned by Boutell Steel Barge Co., Bay City, Mich.; ran aground near Point Edward; released Sept. 29, uninjured.

Sept. 28—Str. A. L. Hopkins, owned by N. D. Carpenter, Detroit; ran aground at Round Island; released same day, uninjured.

Sept. 30—Str. Fayette Brown, owned by Northwestern Transportation Co., Detroit; caught in storm just outside of Lorain and stranded; released Oct. 1 and towed to dry dock; number of bottom plates bent, wheel gone and rudder damaged; left dry dock Oct. 10.

Sept. 30—Car ferry Bge. No. 2; capsized on Lake Michigan; three lives lost.

Sept. 30—Sch. I. V. Taylor, owned by F. M. Ellingson, Chicago; sprung a leak while navigating in severe storm in Lake Michigan; towed to dock.

Sept. 30—Str. City of Concord, owned by D. W. Mills, Cleveland, O.; foundered near Sandusky while out in storm; sank; three lives lost; total loss; boat valued at \$100,000.

Sept. 30—Bge. Negaunee, owned by M. A. Bradley, Cleveland; in tow of steamer City of Concord; total loss.

Sept. 30—Bge. Donaldson, owned by I. U. Karr, Cleveland; in tow of steamer City of Concord while caught in storm on Lake Erie; bulwarks demolished and cargo of coal washed overboard.

Sept. 30—Str. Vulcan, owned by Gilchrist Transportation Co., Cleveland; grounded at Black River shoals; lightered cargo and was released Oct. 2.

Oct. 1—Str. Harlem, owned by H. J. Pauly, Milwaukee; broke air pump just after leaving Detroit river while en route from Fort William to Buffalo; was towed to Cleveland for repairs.

Oct. 1—Str. Castalia, owned by the Brown

Steamship Co., Cleveland; stranded at the foot of the Dyke; released Oct. 2, uninjured.

Oct. 2—Bge. J. C. Magill, owned by Thomas M. Ryan, Buffalo; sprung a leak on Lake Erie; sank next to steamer Tuttle.

Oct. 4—Str. Silver King, owned by Martin Eck, Chicago; stranded at Fisherman's Shoal, Green Bay; broke her wheel and leaked badly; released and taken to Sturgeon Bay same day.

Oct. 4—Sch. Elva, owned by Arnold Transit Co., Mackinaw Island, Mich.; stranded on Plum Island, Green Bay.

Oct. 4—Tug Daniel L. Hebard, owned by Charles S. Hebard, Pequaming, Mich.; stranded on Fisherman's Shoal, Green Bay; went to Sturgeon Bay to receive general rebuilding.

Oct. 4—Str. Sacramento, owned by James Davidson, Bay City, Mich.; ran aground near Buffalo; delayed nine hours; not damaged.

Oct. 4—Bge. City of Toledo, owned by A. Peters, Toledo, O.; sank in American channel above Belle Isle bridge; total loss.

Oct. 5—Pass. Str. Peerless, owned by Chicago Transportation Co.; machinery badly damaged by breaking of an eccentric rod; towed to Milwaukee.

Oct. 5—Str. Winona, owned by R. O. & A. B. McKay, Hamilton, Ont.; ran on rocks at Giant's Tomb Shoal, off Christian Islands.

Oct. 5—Str. J. W. Westcott, owned by Forster Lumber Co., Milwaukee, Wis.; went ashore in dense fog on Round Island; released later in day and proceeded on trip.

Oct. 5—Str. John Crerar, owned by Great Lakes & St. Lawrence Transportation Co., Chicago; broke her rudder while entering Niagara river and was towed to Tonawanda.

Oct. 6—Str. Owego, owned by Union Steamboat Line, Buffalo; machinery broke while navigating on Lake Michigan, near Manitowoc; went to Manitowoc for repairs.

Oct. 7—Sch. Ada Medora, owned by F. W. Baldwin, Petoskey, Mich.; ran on north breakwater at Buffalo, causing her seams to open and fill with water; total loss.

Oct. 8—Str. Benton, owned by Capt. W. J. Willoughby, Goderich, Ont.; ran aground near North Bass Island, Lake Erie, while out in storm; released herself Oct. 10.

Oct. 8—Bge. A. Cobb, owned by M. A. Bradley, Cleveland, O.; grounded near North Bass Island, Lake Erie, while out in storm; released Oct. 15.

Oct. 8—Bge. May Richards, owned by Capt. W. J. Willoughby, Goderich, Ont.; grounded near North Bass Island in storm; filled with water; total loss.

Oct. 8—Bge. Pasadena, owned by M. A. Bradley, Cleveland; ran on rocks near Portage Lake canal in heavy gale; three lives lost; total wreck.

Oct. 9—Str. Joseph Sellwood, owned by Mitchell & Co., Cleveland; ran on east bank of Lime Kiln Crossing; released Oct. 10 and towed to Lorain; grounded again on way to Lorain and remained fast for one day; docked at Lorain Oct. 14; few damaged plates and broken rudder.

Oct. 9—Bge. Wayne, owned by Edward Hines Lumber Co., Chicago; stranded in storm near Fourteen Mile Point, Lake Superior; total loss.

Oct. 9—Bge. S. H. Foster, owned by Edward Hines Lumber Co., Chicago; stranded in storm near Fourteen Mile Point, Lake Superior; total loss.

Oct. 10—Sch. I. B. Comstock, owned by C. A. Eddy, Bay City, Mich.; ran ashore on Duck Island Lake Huron, in storm; total loss.

Oct. 10—Sch. Abram Smith, owned by C. A. Eddy, Bay City, Mich.; ran ashore on Duck Island, Lake Huron, in storm; total loss.

Oct. 10—Str. Langell Boys, owned by C. A. Eddy, Bay City, Mich.; steering gear became disabled while out in storm on Lake Huron.

Oct. 10—Str. Juniata, owned by Erie & Western Trans. Co., Buffalo; 30 ft. of fender strake torn off on port side while out in storm on Lake Superior; stopped at Houghton.

Oct. 10—Bge. Manila, owned by Pittsburg Steamship Co., Cleveland; broke her quadrant while out in storm on Lake Superior; cabins washed away; taken to Fort William for repairs.

Oct. 10—Str. Empire City, owned by Pittsburg Steamship Co., Cleveland; grounded in channel while trying to enter port of Huron, Lake Erie.

Oct. 10—Str. Athabasca, owned by Canadian Pacific Railway, Owen Sound, Ont.; lost signal lights and had rigging badly damaged in storm on Lake Superior.

Oct. 10—Str. Neepawa, owned by R. O. & A. B. McKay, Hamilton, Ont.; her cargo of machinery damaged to extent of about \$4,000 while she struggled through severe storm on Lake Huron, but vessel not damaged.

Oct. 13—Str. Argonaut, owned by D. W. Mills, Cleveland; burned while at dock at Marysville, Mich.; total loss.

Oct. 13—Sch. Hattie Wells, owned by Capt.

Charles Ludwick, Port Huron, Mich.; caught fire while lying alongside of steamer Argonaut; her cabin and after end of boat destroyed.

Oct. 14—Str. Carnegie, owned by Wilson Transit Co., Cleveland; collided with steamer Nottingham at Dark Hole, Sault river; bow badly dented; placed in dry dock Oct. 20.

Oct. 14—Str. Nottingham, owned by United States Transportation Co., Cleveland; collided with steamer Carnegie at Dark Hole, Sault river; bow stove in, starboard anchor carried away, forepeak filled with water, beached; cut clean through from stern to collision bulkhead.

Oct. 14—Str. Lucy Neff, owned by S. O. Neff Transportation Co., Milwaukee, Wis.; disabled by breaking of coupling of engine 15 minutes after she left Port Huron; returned for repairs.

Oct. 14—Str. Three Brothers, owned by James A. White, North Tonawanda, N. Y.; blown ashore near Sandusky; released this date; aground for several days.

Oct. 15—Str. Samuel Mather, owned by Pittsburg Steamship Co., Cleveland; ran on Corsica shoals, near Port Huron; released herself same day, uninjured.

Oct. 15—Str. Walsh, owned by Ohio Steamship Co., Cleveland; ran aground in fog near Sarnia, St. Clair river; released same day, uninjured.

Oct. 15—Sch. Crete, owned by W. C. Richardson, Cleveland; crashed into a pier at Toledo and sank; floated Oct. 30 and towed to Cleveland for repairs; arrived at Cleveland Nov. 5.

Oct. 15—Str. F. L. Robbins, owned by W. H. Becker, Cleveland; collided with steamer Sinaloa near the wreck of the interstate bridge at Duluth; hole cut in her bow and damaged to extent of about \$12,000; took eight days to repair her.

Oct. 15—Str. Sinaloa, owned by G. A. Tomlinson, Duluth; collision with steamer F. L. Robbins near Duluth.

Oct. 16—Str. Mars, owned by the Gilchrist Transportation Co., Cleveland; went ashore on Canadian side of Windmill Point while out in fog; released Oct. 17.

Oct. 16—Str. Three Brothers, owned by James A. White, North Tonawanda, N. Y.; ran on St. Martin's reef near Detour; leaked badly, but proceeded to her destination.

Oct. 16—Str. Frank L. Vance, owned by Vance & Joys, Milwaukee; fire through spontaneous combustion of things in storeroom; \$3,000 worth of damage done to the interior of the vessel, but otherwise not damaged.

Oct. 18—Str. Vulcan, owned by Gilchrist Transportation Co., Cleveland; stranded in fog on Long Point, Lake Erie; released Oct. 19.

Oct. 19—Str. Volunteer, owned by Gilchrist Transportation Co., Cleveland; sprung leak on Lake Superior; went to Marquette for repairs.

Oct. 20—Str. Cherokee, owned by W. S. Brainard, Toledo, O.; ran aground in fog on Canadian side of St. Clair river, colliding with her tow, barge Chippewa; the Chippewa ran into her stern, cutting through into the cabin and down to the water's edge; was taken to dry dock.

Oct. 20—Str. Alfred Mitchell, owned by Lake-side Steamship Co., Duluth; broke bucket off her wheel while leaving Lorain harbor and had to stop at Detroit to have opposite bucket taken off to prevent pounding.

Oct. 20—Str. Cowle, owned by Cowle Transit Co., Cleveland; ran aground on Canadian side of St. Clair river; released Oct. 26, uninjured.

Oct. 22—Str. Auburn, owned by Western Transit Line, Buffalo; ran out four feet on east bank below Grassy Island, near Detroit; released Oct. 26, practically uninjured.

Oct. 22—Str. McLouth, owned by Union Steamboat Line, Buffalo; ran ashore on Gull Island, Lake Michigan; released Oct. 23, uninjured.

Oct. 22—Str. Shenandoah, owned by James Davidson, Bay City, Mich.; lost her rudder near Beaver Island, Lake Michigan, and was towed into Beaver harbor by lighthouse tender Sumac.

Oct. 23—Bge. Chieftain, owned by James Davidson, Bay City, Mich.; collided with steamer Troy on Lake Superior and ran aground at Portage entry near Houghton; big gash in bow down to waterline; towed to Marquette on Oct. 30 for repairs, and narrowly escape foundering while en route to Marquette.

Oct. 23—Str. Cumberland, owned by Gilchrist Transportation Co., Cleveland; crashed into bridge at Buffalo; port bow of steamer smashed; sank; raised Oct. 29.

Oct. 23—Bge. 134, owned by Pittsburg Steamship Co., Cleveland; ran into steamer Kensington lying at anchor at Duluth and damaged three plates, which had to be replaced; Kensington not damaged.

Oct. 23—Sch. Corisande, owned by Canadian parties; collided with steamer Mariska abreast

of Sarnia; towed to Wolverine dry dock, Port Huron, Oct. 25.

Oct. 24—Sch. L. M. Mason, owned by Gun Gunderson, Milwaukee, Wis.; struck south pier at Two Rivers, Lake Michigan; cabin gone and big hole in bow; taken into the harbor and put in dry dock.

Oct. 24—Str. Sultana, owned by G. A. Tomlinson, Duluth; got stuck in outer harbor at Erie on account of low water.

Oct. 25—Str. Roebing, owned by Pittsburg Steamship Co., Cleveland; ran aground in storm in St. Clair flats; released Oct. 26 and towed to Lake Erie.

Oct. 25—Str. Wissahickon, owned by Eric & Western Trans Co., Buffalo; machinery disabled on Lake Michigan shortly after she left Chicago; towed back for repairs.

Oct. 25—Sch. Neilson, owned by Pittsburg Steamship Co., Cleveland; stranded on Faise Presque Isle, Lake Huron; released same day, slightly injured.

Oct. 27—Str. Christopher, owned by W. H. Meyer, Milwaukee, Wis.; ran aground while entering harbor of Sandusky.

Oct. 27—Bge. M. B. Grover, owned by M. A. Bradley, Cleveland; caught fire in storm while anchored at Cleveland breakwater; very badly burned, but not a total loss.

Oct. 27—Str. Lackawanna, owned by Lake Transit Co., Buffalo; struck concrete pier and ran on the rip-rap in storm at Cleveland; abandoned to underwriters; released Nov. 8; placed in dry dock Nov. 13.

Oct. 28—Str. Pathfinder, owned by Pickands, Mather & Co., Cleveland; struck obstruction near White Rock, off Harbor Beach, Mich., and broke her wheel; drifted ashore; released Oct. 2 and repaired sufficiently to be taken to dry dock; towed to Cleveland and placed in dry dock Nov. 7.

Oct. 28—Str. Alva, owned by M. A. Bradley, Cleveland; lost anchor and chain on St. Clair river; sank following day; raised and arrived at Ecorse ship yard Nov. 7 for repairs; eight plates taken off.

Oct. 28—Bge. Thomas H. Cahoon, owned by Shannon & Garey, Saginaw, Mich.; broke from steamer Homer Warren during storm on Lake Huron; picked up by a steamer during the night; not damaged.

Oct. 29—Str. Wisconsin; collided with steamer Alva; two plates and three frames badly cracked and bent on starboard bow, temporarily repaired; later taken to Superior for repairs.

Oct. 29—Str. Shenandoah, owned by James Davidson, Bay City, Mich.; lost rudder while in storm on Lake Michigan, and was towed to East Tawas.

Oct. 29—Sch. Vienna, owned by F. H. & T. E. Laird, Dresden, Canada; sprung a leak in Lake Michigan and sank; total loss.

Oct. 29—Sch. West Side, owned by Bertha Dahlke, Cleveland; lost on Lake Huron while out in snow storm; total loss.

Oct. 29—Lighter Elgin, owned by Capt. John Schea, Duluth, Minn.; went to pieces at Grand Marais, Lake Superior, in storm; total loss.

Oct. 29—Tug Pinola, owned by Standard Contracting Co., Cleveland; sank near Sandusky, Lake Erie, in storm.

Oct. 30—Bge. Checotah, owned by Henry McMoran, Port Huron, Mich.; her deck load was washed away; filled with water and sank in Port Huron; raised later and converted into a dredge, now being owned by Edward Gillen Dock & Dredge Construction Co., Racine, Wis.

Oct. 30—Str. Livingstone, owned by Wm. Livingstone, Detroit; badly shaken up in gale on Lake Superior; after deckhouse smashed by seas and much of it swept away.

Oct. 30—Str. Fayette Brown, owned by Northwestern Trans. Co., Detroit; collided with barge Bottsford at Sault; not damaged.

Oct. 30—Bge. Bottsford, owned by Saginaw Bay Transportation Co., Cleveland; collided with steamer Fayette Brown at the Sault; was struck on starboard side and had to be beached to prevent sinking; temporarily repaired and left to proceed on her trip Nov. 1.

Oct. 30—Bge. John Fritz, owned by Pittsburg Steamship Co., Cleveland; struck bridge at Duluth.

Oct. 31—Steamer G. J. Grammer, owned by Seither Transit Co., Cleveland; went aground abreast of Point Edward's elevator, Canadian side; released later in the day, uninjured.

Nov. 1—Str. Harold B. Nye, owned by W. A. Hawgood & Co., Cleveland; struck west abutment of swing bridge at Ashtabula, causing several hundred dollars' worth of damage to bridge; steamer not damaged.

Nov. 2—Sch. S. A. Wood, owned by James A. Myers, Chicago; badly burned while lying at dock at Chicago.

Nov. 2—Str. Mars, owned by Gilchrist Transportation Co., Cleveland; ran aground in fog at head of Stag Island, St. Clair river; released Nov. 3 and proceeded to her destination, apparently not injured.

Nov. 2—Str. Northern Queen, owned by Mu-

tual Transit Co., Buffalo; broke her wheel and damaged her rudder; stopped for repairs.

Nov. 4—Str. Bickerdike, owned by Merchants Line, Montreal, Canada; ran on rocks three miles below Alexandria Bay, St. Lawrence river.

Nov. 4—Str. Philip Minch, owned by Kinsman Transit Co., Cleveland; ran aground in Lake Erie near Buffalo.

Nov. 4—Str. America; broke rudder pin 10 minutes after leaving Duluth; repaired in a day.

Nov. 5—Str. Robert Fulton, owned by Pittsburg Steamship Co., Cleveland; ran on rocks at head of Bois Blanc Island, Detroit river, during fog; released Nov. 8.

Nov. 5—Str. George Peavey, owned by Peavey Steamship Co., Duluth; ran on rocks at head of Bois Blanc Island, Detroit river, during fog; released; stranded later on Ballard's reef; released Nov. 9 and towed to Buffalo; damaged quite extensively.

Nov. 5—Str. C. A. Black, owned by Pittsburg Steamship Co., Cleveland; ran on rocks at Ballards reef, Detroit river, in heavy fog; released Nov. 6 after lightening part of her cargo.

Nov. 6—Str. W. H. Gilbert, owned by Pittsburg Steamship Co., Cleveland; ran on rocks at Avon Point, Detroit river; released Nov. 7, uninjured.

Nov. 6—Str. Henry Cort, owned by Pittsburg Steamship Co., Cleveland; considerably damaged by fire while at Central furnace dock at Cleveland.

Nov. 7—Str. Harlow, owned by W. J. Harlow, Toledo, O.; stranded near head of Fighting Island, Detroit river.

Nov. 8—Str. Colgate, owned by Pittsburg Steamship Co., Cleveland; lost her wheel in Mud Lake and was towed to Cleveland on the 12th.

Nov. 10—Str. Iowa, owned by Goodrich Line, Chicago; stranded at Hill's Point, Green Bay, in fog; released Nov. 11 after lightening part of cargo.

Nov. 10—Sch. Isabella Sands, owned by Louis Sands, Salt & Lumber Co., Manistee, Mich.; stranded at Hill's Point, Green Bay, in fog.

Nov. 10—Str. Wyoming, owned by the Red Star Line, Buffalo; stranded at the Dyke, St. Mary's river.

Nov. 11—Str. D. C. Whitney, owned by Gilchrist Transportation Co., Cleveland; damaged by fire which broke out in forward part of steamer.

Nov. 12—Bge. Quebec, owned by Montreal Transportation Co., Montreal, Canada; went ashore in storm near Charlotte, Lake Huron.

Nov. 12—Str. Owego, owned by Union Steamboat Line, Buffalo; disabled her machinery while navigating in storm in Lake Michigan, and stopped at Manitowoc for repairs.

Nov. 13—Bge. Martha, owned by Pittsburg Steamship Co., Cleveland; steering gear disabled and anchor lost while in storm in St. Clair river; arrived at Cleveland in tow of steamer Poe this date.

Nov. 14—Str. Strathmore; wrecked at Michipicoten, Lake Superior; total loss.

Nov. 14—Str. James Fisk, owned by Alvin Peter, Toledo, O.; burned near St. Clair flats; total loss; wreck bought by Capt. H. Baker.

Nov. 14—Bge. I. L. Bell, owned by Pittsburg Steamship Co., Cleveland; collided with steamer Seguin in St. Clair river, but proceeded on her way; later sank with a 20-ft. hole in her side, floated Nov. 25 and repaired at Ecorse, where she wintered.

Nov. 14—Str. Seguin, owned by J. B. Miller, Toronto, Ont.; collided with barge Bell in St. Clair river and sank at Sarnia; big hole torn in her side.

Nov. 14—Str. Oscoda, owned by Hines Lumber Co., Chicago; stranded on a reef east of Round Island, Bay De Noque; released Nov. 15, after lightening about 80,000 ft. of lumber.

Nov. 14—Bge. D. L. Filer, owned by Hines Lumber Co., Chicago; in tow of steamer Oscoda; stranded on a reef east of Round Island; released Nov. 15 after lightening.

Nov. 14—Bge. Guido, owned by John Campbell, Port Huron, Mich.; stranded on a sand bar off Cedar Point, Lake Erie.

Nov. 15—Str. W. H. Gratwick; stranded on Lake Michigan, near Chicago; not damaged.

Nov. 16—Str. Orion, owned by Green Bay Vessel Co., Green Bay, Wis.; stranded on North Point, Lake Michigan, during storm; not severely damaged.

Nov. 17—Sch. Margaret Dall, owned by Henry Caesar, Chicago; ran ashore at South Manitou Island, Lake Michigan, during storm; total loss.

Nov. 17—Sch. Horace Taber, owned by A. Swenson, Chicago; ran ashore at South Manitou Island, Lake Michigan, during storm, near schooner Dall; uninjured.

Nov. 17—Str. Winona, owned by Navigation

Co. of Port Stanley, Port Stanley, Canada; ashore at Graham Shoal beach, Manitoulin Island, Lake Huron; released Nov. 19 and taken to Collingwood for repairs; arrived at Collingwood Nov. 30 and put in dry dock.

Nov. 17—Str. Theano, owned by Algoma Central Steamship Line, Sault Ste. Marie, Ont.; struck a rock near Thunder Cape, Lake Superior; total loss.

Nov. 18—Str. James E. Davidson, owned by G. A. Tomlinson, Duluth; collided with Minnesota draw of Northern Pacific bridge at Duluth; bridge damaged, but steamer not seriously hurt.

Nov. 19—Str. Fairmount, owned by Montreal Trans. Co., Montreal, Canada; two plates loosened while out in storm on Lake Superior; stopped at Fort William for repairs, which took one day to make.

Nov. 20—Str. Mohegan, owned by Holland & Graves, Buffalo, struck breakwater at Buffalo; took 10 days to repair her.

Nov. 20—Government survey steamer Search; became disabled after completing some work in the vicinity of Sturgeon Bay, and was obliged to return there for repairs.

Nov. 21—Str. Bay City, owned by Boutell Steel Barge Co., Bay City, Mich.; became disabled near Colchester, Lake Erie, and was towed to Lorain.

Nov. 21—Str. Gladstone, owned by M. A. Bradley, Cleveland; struck in Pelee passage, Lake Erie, and damaged her rudder.

Nov. 21—Str. Mariposa, owned by Pittsburg Steamship Co., Cleveland; stopped at Cleveland for repairs to her machinery.

Nov. 21—Str. Gilbert, owned by Pittsburg Steamship Co., Cleveland; collision with steamer W. A. Rogers at Port Huron, St. Clair river; ordered to Toledo to lay up for winter on Nov. 23.

Nov. 21—Str. W. A. Rogers, owned by Niagara Transit Co., North Tonawanda, N. Y.; collision with steamer Gilbert at Port Huron, St. Clair river; temporarily repaired Nov. 23.

Nov. 22—Str. Maritana, owned by Pittsburg Steamship Co., Cleveland; went aground in channel at Bar Point, Detroit river, on account of low water; released later same day; not damaged.

Nov. 22—Str. D. M. Whitney, owned by Gilchrist Transportation Co., Cleveland; went to the bottom at Bar Point, Detroit river, on account of low water; released after lightering considerable of her cargo; proceeded on her trip Nov. 23.

Nov. 22—Bge. Antrim, owned by Gilchrist Transportation Co., Cleveland; ran aground at Bar Point, Detroit river, in low water; lightered cargo; released Nov. 24.

Nov. 22—Bge. Athens, owned by Lake Erie Transportation Co., Cleveland; broke away from steamer P. P. Pratt in storm on Lake Erie; quadrant was broken, steering gear disabled and leaked badly; towed to Erie to unload; resumed trip Nov. 25.

Nov. 22—Str. Panama, owned by James Davidson, Bay City, Mich.; stranded on Lake Superior during storm; lost rudder; abandoned by owner Dec. 4 as total loss.

Nov. 22—Str. Resolute, owned by Deseronto Navigation Co., Deseronto, Ont.; foundered in Lake Ontario during storm; sprung a leak; six lives lost; vessel total loss.

Nov. 22—Str. Helen Taylor, owned by M. O. Clucky, Pentwater, Mich.; lost on Lake Michigan during storm.

Nov. 22—Str. Charles B. Hill, owned by Great Lakes Engineering Works, Detroit; beached at North Madison, Lake Erie, to prevent foundering in heavy gale; seams opened and she filled with water; total loss.

Nov. 22—Str. C. A. Black, owned by Pittsburg Steamship Co., Cleveland; upper works badly damaged by heavy seas on Lake Michigan.

Nov. 22—Str. C. Hurlbut, owned by Teagan Bros., Detroit, Mich.; stranded on Lake Erie during storm; lost her rudder; released Nov. 27; taken to Toledo Dec. 4.

Nov. 22—Str. Conemaugh, owned by Anchor Line, Buffalo; ran ashore at Pointe Pelee, Lake Erie, during storm; abandoned by owners as total loss Dec. 3, who claim she can be floated and saved.

Nov. 22—Str. P. P. Pratt, owned by Lake Erie Transportation Co., Cleveland; badly crippled while out in storm on Lake Superior; temporarily repaired and went to Buffalo to unload ore.

Nov. 22—Tug Frank W., owned by Great Lakes Towing Co., Cleveland; badly battered in storm while trying to aid disabled steamer Bay City at Colchester.

Nov. 22—Tug T. C. Lutz, owned by Great Lakes Towing Co., Cleveland; windows and doors all broken while out in storm trying to help disabled steamer Bay City off Colchester.

Nov. 22—Car ferry Pere Marquette No. 16, owned by Pere Marquette Steamship Co., Milwaukee, Wis.; stranded in Green Bay near Peshtigo during storm; released Nov. 23, uninjured.

Nov. 22—Str. Frontenac; skylight wrecked over engine-room and otherwise damaged while out in storm on Lake Michigan.

Nov. 22—Bge. Clint, owned by Teagan Bros., Detroit; foundered in storm off Colchester; towed to Amherstburg Nov. 25, uninjured.

Nov. 22—Str. Comfort; sprang a leak near Marine City and was beached.

Nov. 22—Str. Joliet, owned by Pittsburg Steamship Co., Cleveland; ran into dock at Marine City while out in storm, damaging dock, but vessel not injured; cost of damage to dock, about \$1,000.

Nov. 22—Str. Shaw, owned by Pittsburg Steamship Co., Cleveland; ran upon the foundation of an old pier at Ashtabula, Lake Erie, but was not damaged.

Nov. 22—Bge. Commodore; rudder disabled and hawse pipes pulled out by her chain; towed to Ashtabula.

Nov. 23—Str. J. D. Scott, owned by J. F. Scott, Rochester, N. Y.; grounded in Lake Ontario near Pultneyville, while being towed to Sodus Point for the winter; doubtful whether she can be saved.

Nov. 25—Str. Curry, owned by H. A. Hawgood, Cleveland; grounded on Southeast Shoal, near Amherstburg, Detroit river.

Nov. 26—Str. Pere Marquette No. 5, owned by Graham & Morton Line, Chicago; went aground in Portage Lake; released Nov. 28.

Nov. 26—Str. Lucy Neff, owned by S. O. Neff Transportation Co., Milwaukee; ran aground at Windmill Point; was released Nov. 27, uninjured.

Nov. 26—Whaleback Bge. 118, owned by Pittsburg Steamship Co., Cleveland; broke away from steamer Eads in storm on Lake Erie; picked up on Nov. 29 and towed up the lakes.

Nov. 26—Bge. Agawa, owned by the Algoma Central Steamship Line, Sault Ste. Marie, Ont.; broke away from steamer Leafield near Eagle Harbor, Lake Superior, in storm; picked up Nov. 28 and taken to Sault Ste. Marie; not damaged.

Nov. 28—Str. Turret Crown, owned by Canadian Lake & Ocean Navigation Co., Toronto, Canada; went ashore near Grand Marais, Lake Superior; released Nov. 30; docked at Cleveland Dec. 5 for repairs.

Nov. 28—Str. Susquehanna, owned by Anchor Line, Buffalo; struck pier while entering Duluth harbor in heavy sea; not seriously injured.

Nov. 28—Str. Wm. Chisholm, owned by Minch & Nicholas Transit Cos., Cleveland; ran aground at Rouleau Point, Lake Superior; released Nov. 30 after lightering 30,000 bushels of barley; not damaged.

Nov. 29—Str. Tecumseh, owned by Macarthus Bros. Co., Detroit; stranded in South Passage of Lake Erie; arrived at Amherstburg Dec. 2, towed by a tug; bottom badly damaged; at Ecorse yards Dec. 3 for repairs.

Nov. 30—Str. Queen of the Lakes, owned by Richardson & Sons, Kingston, Ont.; sprang a leak while navigating in storm on Lake Ontario; sank; total loss.

Dec. 1—Car ferry Ashtabula, owned by Pennsylvania & Ontario Steamship Co., Ashtabula, O.; coal cars became loose and crashed into pumping post at Ashtabula, causing considerable damage; vessel was slightly raised for repairs to her propeller wheel.

Dec. 3—Ann Arbor car ferry No. 1, owned by Ann Arbor Railroad & Steamship Line, Toledo, O.; loaded freight cars broke loose while in heavy weather on Lake Michigan; considerable damage done to deck of car ferry.

Dec. 3—Car ferry Pere Marquette No. 6, owned by Michigan Salt Transportation Co., Milwaukee; rudder chain parted while on Lake Michigan and she stopped at Ludington for repairs. Hand steering gear saved her from running on the beach.

Dec. 3—Str. Northern Queen, owned by Mutual Transit Co., Buffalo; ran on Abbey Point, Lake Superior, in heavy snow storm; released Dec. 5.

Dec. 5—Bge. Hickox, owned by Belknap & Phillips, St. Clair, Mich.; burned off Kingston, Lake Ontario, with cargo; crew escaped; total loss.

Dec. 6—Str. John Harper, owned by Gilchrist Transportation Co., Cleveland; hole 3 ft. long cut in side of vessel by ice in Lily Pond.

Dec. 6—Str. Italia, owned by James Corrigan, Cleveland; grounded in Mackinaw Bay.

Dec. 6—Bge. Amazon, owned by James Corrigan, Cleveland; grounded in Mackinaw Bay; released later in day, uninjured.

Dec. 6—Bge. Wawanosh, owned by Sarnia Trans. Co., Sarnia, Ont.; broke away from tug Spencer and ran aground near Oscoda, Lake Huron; total loss.

Dec. 7—Str. James Laughlin, owned by the Interstate Steamship Co., Cleveland; blown ashore at Lime Kiln Crossing; released same day and taken to Detroit for repairs; left Detroit Dec. 10.

Dec. 7—Str. R. I. Ireland, owned by Gilchrist Transportation Co., Cleveland; ran ashore on Gull Island reef, Lake Superior, in snow

storm; released Dec. 12 and docked for repairs.

Dec. 7—Str. Golspie, owned by R. O. & A. B. McKay, Hamilton, Ont.; stranded in Brule Bay, near Michipicoten, Lake Superior; total wreck.

Dec. 8—Str. Ionic, owned by Ionia Transportation Co., Detroit, Mich.; ran ashore while navigating through ice in White Fish Point, Lake Superior; released Dec. 11, and proceeded on trip, apparently uninjured.

Dec. 9—Str. Monarch, owned by Northern Navigation Co. of Ont., Ltd., Collingwood, Ont.; went ashore on Isle Royale, Lake Superior; one man drowned; total loss.

Dec. 10—Str. F. H. Prince, owned by Rutland Transit Co., Ogdensburg, N. Y.; was cut through by ice while entering harbor at Ogdensburg; cargo damaged.

Dec. 10—Str. Caribou, owned by United States & Dominion Trans. Co. (A. Booth & Co.), Chicago; disabled near Killarney, Georgian Bay, and towed to Owen Sound.

Dec. 11—Bge. Connelly Bros., owned by J. A. Calbeck & Co., Chicago; struck at the Dyke in the Soo river while navigating in ice.

Dec. 11—Str. Binghamton, owned by Union Steamboat Line, Buffalo; ran ashore near Skillagalee light; temporarily repaired on the 14th; docked Dec. 30, badly damaged.

Dec. 13—Str. F. B. Squire, owned by Jenkins Steamship Co., Cleveland; ran aground near Grosse Point in heavy fog; released Dec. 15 and reloaded lightered cargo.

Dec. 14—Str. Milwaukee, owned by Western Transit Co., Buffalo; wheel chains parted and she went on rocks at Amherstburg, Detroit river; released Dec. 15, and proceeded to Buffalo.

Dec. 14—Str. Phenix, owned by J. J. Rardon, Chicago; stranded on Cheboygan Point in heavy gale and snow storm; released herself later in the day, but leaked badly; grounded again on the 17th, but released on the 20th.

Dec. 15—Str. John M. Nicol, owned by J. J. Boland, Buffalo; ran ashore at Big Summer Island, Green Bay; total loss.

Dec. 16—Tug Adventurer, owned by Joseph Bullion, Ontonagon, Mich.; ran ashore near Ontonagon lighthouse; will be abandoned and machinery will be installed in steamer Mary Bell.

Dec. 16—Str. L. C. Waldo, owned by Roby Transportation Co., Detroit; ran ashore on a reef north of Garden Island, Lake Michigan; released Dec. 19, uninjured.

Dec. 18—Str. Sahara, owned by G. A. Tomlinson, Duluth; severely battered through sudden release of ice jam at Buffalo; repairs will cost several thousand dollars.

Dec. 18—Str. Commodore, owned by Western Transit Co., Buffalo; severely damaged by sudden release of ice jam at Buffalo.

Dec. 18—Tug Williams, owned by Buffalo Dredging Co., Buffalo; was forced under a bridge at Buffalo by ice jam and her upper works were raked off.

Dec. 28—Car ferry Ashtabula, owned by Pennsylvania & Ontario Steamship Co., Ashtabula, O.; ran ashore near Port Burwell, Lake Erie; released Dec. 30, not damaged.

The Board of United States Inspectors of Steam Vessels which has been taking testimony at New Orleans in regard to the sinking of the American steamer Hugoma in the Mississippi river at New Orleans in collision with the French cruiser Kleber on the night of Feb. 20th last, has exonerated Capt. R. W. Lewis and Pilot W. F. Shaw of the Hugoma, placing the blame for the accident on the battleship. They charge that the battleship should have ported her helm. The Hugoma was a lake-built steamer and was operated on the lakes for a number of years before she was purchased by the New York & Porto Rico Steamship Co.

The new steamer now being constructed by the Portland Co. of Portland, Me., for the Winter Harbor Co. of Philadelphia, will be equipped with one No. 15 Roberts safety water tube boiler.



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LEAGUE PRIZE.

Judge Robert W. Tayler of the United States district court for the northern district of Ohio, Rev. J. Leonard Levy, the eminent Jewish rabbi of Pittsburg, and Mr. Frank D. Lelanne, a retired merchant of Philadelphia and president of the National Board of Trade, have consented to act as judges in awarding the four prizes of \$400, \$300, \$200, and \$100 for the four best essays on "How to build up our shipping in the foreign trade," that were offered last fall by the Merchant Marine League of Cleveland. These essays, as will be remembered, have been prepared by students in high schools, technological schools, colleges and universities in the United States. Announcement of the successful contestants will be made as

soon as the judges have completed their examinations of the numerous manuscripts submitted. It is expected that the league will publish the winning essays and distribute them throughout the United States as a part of its extended educational propaganda.

PACIFIC SUPREMACY.

It ought to require but little consideration to convince anyone that the United States is drifting into a dangerous condition. Enormous internal prosperity has obscured this condition but has by no means obliterated it. It exists. The need of being self-contained as a shipping nation was well understood when the republic was young, but it is not as well understood now, or to speak more accurately, the pressure of other things has crowded it out of the public sight. It was a necessity then, however; it is a necessity now.

The great representative of the Caucasian race on the Pacific ocean is the American people. Is this ocean to be absolutely given over to the yellow and brown? It would appear so. As far as shipping is concerned, the United States is asleep, while the little nation in the Far East is wide awake. Within ten years Japan has built her merchant marine from a tonnage of 170,000 to 1,000,000. In ten years she acquired a surplus tonnage and is bidding for the carrying trade of other nations. The department of communication of Japan has just asked for a subsidy of 6,942,569 yen for 1907, an increase of 746,388 yen over the subsidy of last year. This subsidy is distributed as follows:

Australian line	473,092 yen
China line	800,000 "
European line	2,673,895 "
Seattle line	654,030 "
San Francisco line	1,013,880 "
Oriental Coast line	530,000 "
Japan sea line	351,000 "
Ogasawara line	15,480 "
Oki line	22,800 "
Pinkin Island line	14,440 "
Hokkaido line	180,512 "
Dalney line	140,000 "
Izu Shichido line	7,560 "
Other Island line	14,440 "

The yen is equivalent to the American half dollar.

These immense subsidies are directly responsible for the development of this shipping of Japan in the Pacific trade. It is absolutely clear that within a year or two Japan will control shipping on the Pacific trade. Three steamships are

now being built in Japan, practically duplicates of the Corea and Siberia, two of the largest liners in the Pacific trade. Incidentally overtures have been made by the Japanese for the purchase of the leading American steamers now engaged in the Pacific trade. The end of American shipping on the Pacific is certainly in sight. The shipping bill which was passed by the last congress contained no provision for a service to the orient. Of course, the bill did not become law, but even if it had, it would not have aided our shipping upon this mighty ocean. It seems to us that this policy is extremely short-sighted. There is practically no maritime nation on earth that does not generously assist its shipping, either through direct subsidy or favorable laws. The report is frequently circulated that British shipping is not subsidized, but British shipping enjoys subsidies from the colonies. German shipping enjoys a preferential in railway carriage throughout Germany. All nations seem to recognize the necessity of aiding shipping except the United States.

It is a disgrace that an American citizen can traverse the seven seas without once seeing the American flag flying from the stern of a steamer. He can see the flags of all nations except the one that he most of all would like to see.

FREIGHT SITUATION.

Weather conditions have moderated greatly during the past few days and navigation may open earlier than was expected a week ago. Reports from upper lake ports indicate that ice is softening rapidly and the lower rivers seem to be fairly free from it. In all probability the season of navigation will open between April 15 and 20. The D. & C. passenger boats start this week. The shipyard strike has not spread beyond its original dimensions and will have no effect whatever upon lake trade during the coming season. Shippers are speaking of a movement of 42,000,000 tons of ore as a maximum, and there is certainly ample tonnage to handle this movement easily. While the wild rate on ore will in all probability work out evenly with the contract rate throughout the entire year, it is already clear that the wild coal rate will work out at a better figure than the contract rate. The contract rate on coal is not equivalent to the contract rate on ore and none of the larger class of carriers will touch this commodity at the present figure. Some of the smaller vessels of the Pittsburg Steamship Co. will

carry coal up on their first trip, but the corporation will carry no more coal in its own vessels than is necessary to meet the requirements of its own railways and mines. The hard coal shippers were in the market at Buffalo for tonnage during the week, and were compelled to pay an advance of five cents to Chicago over the prevailing rate to Lake Michigan. The soft coal rate immediately advanced in sympathy, one Cleveland vessel owner taking a contract to move 50,000 tons to Lake Michigan at 50 cents.

The stages of water are low and masters of the Pittsburg Steamship Co.'s vessels have been notified not to load deeper than 17½ ft.

IRON SITUATION.

A scarcity of semi-finished material has curtailed the normal product in many iron and steel mills during the past week, and a few of them have totally suspended operations. As yet there is no retrenchment apparent on the part of the railroads. An important eastern line has made a second addition to rail tonnage originally ordered. Heavy specifications are being received from steel car interests on plate contracts, and the situation in this product is extremely strong, causing premiums to be freely paid. There is a good inquiry for shapes and in steel bars the demand is very active with deliveries far behind. Premiums offered for prompt delivery have been refused on account of the mills' inability to make shipments on contracts. Pig iron is firmer. The recent heavy buying by the Carnegie Steel Co. and the Cambria Steel Co. and the announcement that their requirements are not yet filled has strengthened the market. Bessemer pig iron has advanced from 50 cents to \$1 per ton for second quarter delivery. Prompt foundry iron is scarce.

LAUNCHING THE H. P. McINTOSH.

The bulk freighter H. P. McIntosh, building at the West Bay City yard of the American Ship Building Co. for the Gilchrist Transportation Co., of Cleveland, was launched on Wednesday of this week and was christened by Miss Olive Marie McIntosh in honor of her father. The loyalty of the men to the shipyard during the present trouble with labor was recognized by the board of trade of Bay City, a luncheon being tendered to the men by the board of trade after the launch, the business men of Bay City acting as waiters. The party from Cleveland included Mr. H. P. McIntosh, J. C. Gilchrist, F. W. Hart, Capt. J. L. Weeks, James Mitchell and Robert Logan.

The McIntosh is a duplicate of the Steamer Gen. Garretson, and is 540 ft. over all, 520 ft. keel, 54 ft. beam and 31

ft. deep. She has sixteen hatches spaced 24-ft. centers. Her engines are triple-expansion with cylinders 22½, 36, and 60 in. diameters by 42-in. stroke, supplied with steam from two Scotch boilers, 13 ft. 9 in. in diameter and 11½ ft. long, fitted with Ellis & Eaves draft and allowed 180 lbs. pressure. Capt. W. E. Stewart will sail the McIntosh.

MONOLITHIC FLOORING ON LAKE SHIPS.

The C. Clemente Co., Park building, Cleveland, manufacturers of Sawdolet, a monolithic flooring, has received an order from the American Ship Building Co. to fit out eleven steamers with this flooring. These steamers include the J. C. Morse, Elba, Leland S. DeGraef, W. M. Mills, Odonah, Crete, Cyprus, Adriatic, Verona, and 356 and 357, which are at present unnamed. This flooring has met with great success upon the vessels on which it has already been introduced. The flooring is practically indestructible, being impervious to liquids and dust. It is fire proof and is an especially poor conductor of heat. Through its use it is possible to make cool and desirable living quarters over the boilers. When applied the substance is plastic, about the consistency of mortar, made up of pulverized and granular wood fibre and mineral substances. It can be colored to meet any decorative scheme, solidifying into a compact and lasting floor within a few hours.

SUB-MARINE SIGNALS ON THE LAKES.

The Pittsburg Steamship Co. of Cleveland, operating a fleet of over 100 ore carriers on the Great Lakes, have ordered the equipment of the following steamers with submarine signals: G. W. Perkins, Sir William Fairbairn, Norman B. Ream, Saml. F. B. Morse, Rensselaer, Douglas Houghton, J. Pierpont Morgan, W. E. Corey, E. H. Gary, H. C. Frick, Peter A. B. Widener and H. H. Rogers.

ITEMS OF GENERAL INTEREST.

Capt. A. C. Majo of Duluth has purchased the small steamer Crescent of Charlevoix.

Richard J. Flinn, West Roxbury, Mass., has put out a little circular descriptive of the Flinn Steam Trap.

Mr. Harry Coulby, president and general manager of the Pittsburg Steamship Co., will probably return from England next week.

Mr. E. T. Laundon, formerly with Corrigan, McKinney & Co., has opened a general insurance office in the Western Reserve building, Cleveland.

Pickands, Mather & Co. entertained the captains of their lake fleet at dinner at the Hollenden on Tuesday. Mr. W.

P. Murray of Pickands, Mather & Co., presided.

The San Francisco Dry Dock Co., San Francisco, Cal., is having plans for a new dry dock at Hunter's Point alongside the other two docks. The new dock will approximate 1,000 ft. in length.

The charter of the Ross Valve Co. having expired, George Ross, his sons, Wm. Ross, John C. Ross and Adam Ross II will continue the business as successors under the firm name of the Ross Manufacturing Co., Troy, N. Y.

The Clinton Ship Building & Repair Co. has been formed in Philadelphia to engage in ship building. The yards are located at the foot of Tioga street. Mr. E. B. Clinton is president, E. T. Jacobs manager, and Joseph F. Clinton, treasurer.

The Peoples Line between New York and Albany and the Citizens Line between New York and Troy—now a part of the consolidated steamship lines—have just put out an excellent folder concerning their service.

The Safety Car Heating & Lighting Co. and Pintsch Compressing Co., of New York, announce the removal of their offices on March 16 to the seventeenth floor of the United States Express building, Trinity place and Rec-tor street, rear of Trinity church.

The Racine Boat Manufacturing Co., Muskegon, Mich., has received contract from the government for a steel light ship 88 ft. in length to cost \$40,000. The light ship will be self-propelling, having a triple-expansion engine and water-tube boilers.

Mr. Henry J. Weidenthal, a well-known newspaper man of Cleveland, has been appointed contracting passenger agent for the Lake Shore Navigation Co., which will operate the steamer Eastland between Cleveland and Cedar Point during the coming summer.

The Rev. E. W. Matthews, secretary of the British and Foreign Sailors Society, London, England, who has been on a tour round the world, and presented some gifts of Victory copper to the White House was entertained to lunch by the directors of the American Seamen's Friend Society, N. Y. During the lunch the president, C. A. Stoddard, announced that Mrs. Russell Sage had given \$150,000 to the New Seamen's Institute to be erected on West street. Mr. Matthews, on behalf of the British and Foreign Sailors Society, and in the name of the king, asked the president, to present as a souvenir of the occasion to Mrs. Sage, a bust of Nelson, mounted on oak, taken from the timbers of Admiral Lord Nelson's former flag ship Victory. This is the largest gift ever given the merchant seamen's cause.

AROUND THE GREAT LAKES.

The report generally circulated in the newspapers that masters whose licenses are five or six years old would have to be re-examined, is without foundation.

A new McMyler coal loader has been installed on the Wheeling & Lake Erie dock at Cleveland, having a capacity of loading twenty-five cars per hour from dock to vessel.

Capt. Henry Leisk, of Milwaukee, one of the best known masters on the lakes, has decided to quit sailing. He has opened an office at Milwaukee and will make surveys and look over repair work.

Hutchinson & Co., of Cleveland, have sold the schooner Emma C. Hutchinson to Capt. Wm. Strong of Tonawanda. The schooner was built at Port Huron in 1873 and is 196 ft. long.

The deal for purchasing all the lumber yards and docks of the Eastern Lumber Co. of Tonawanda by the Cloquet Lumber Co., of Cloquet, Minn., of which Frederick Weyerhaeuser is the principal owner, has been closed and the new firm will take over the business on May 1.

The International Brotherhood of Steam Shovel, Dredge, Firemen, Deck Hands and Scow Men of America elected the following officers: President, W. B. Jones, Detroit; secretary, Claude Wirth, Detroit; vice presidents, B. F. Disbrow, Cleveland; B. Fenaughty, Buffalo; Albert Eagle, Sault Ste. Marie, and Hip Thomas, Superior.

Much satisfaction is expressed in marine circles over the promotion of Capt. Alex J. McKay, who will bring out the new steamer City of Cleveland, to the rank of commodore of the Detroit & Cleveland Co.'s fleet. This office has not been effective since David Carter died. Capt. McKay has been with the D. & C. Co. for 31 years.

The Milwaukee-Western Steamship Co. has been incorporated with the following incorporators: Charles W. Moody and Edward A. Uhrig of the Milwaukee Western Coal Co., and Carl C. Joys, who has been identified with lake navigation for many years. The steamer Manchester has been purchased. The purpose of the company is to enter the coal trade.

After investigating the collision between the liner Binghamton and the government steamer Hancock which resulted in the sinking of the Hancock above Grosse Point lightship, Aug. 16, 1905, local inspectors Galway and Meno of Detroit find no willful violation of the rules of the steamboat inspection service and dismissed the case.

The Duluth, Mesabi & Northern Railroad is to erect a coal dock on its property immediately east of ore dock No. 1 at Duluth. Contract for the structure has been awarded to the Barnett & Record Co. The towers and bridge will be furnished by the Mead-Morrison Manufacturing Co., Chicago, and the electric equipment by the Westinghouse Electric Manufacturing Co. of Pittsburgh.

The Craigs of Toledo have entered into contract with the Los Angeles Dock & Terminal Co., Los Angeles, Cal., to establish a ship building plant at Long Beach, Cal. The dock and terminal company deeded to the Craigs 43 acres of land as a bonus; in return the Craigs bind themselves to spend \$250,000 on the plant during the first year. It is understood that contracts for two ships have already been secured.

Major Charles Kellar, of Detroit, lighthouse engineer in charge of the eleventh district, has been placed in charge of the work of the United States Lake Survey which had previously been under the direction of Col. G. J. Lydecker, division engineer, retired. Major Kellar's work on rivers and harbors extending from Monroe to Cheboygan has been turned over to Col. Charles E. L. B. Davis.

About 1,730,000 bushels of grain have been loaded into vessels at Chicago for shipment at the opening of navigation. Of this amount, 1,100,000 bushels is corn, 300,000 is oats and the balance is wheat. The vessels are the Western Star, W. L. Brown, Saturn, W. P. Rend, England, Black Rock, Morley, R. R. Rhodes, Parks Foster, Oglebay, and Lewiston. The grain is consigned to Buffalo with the exception of the Parks Foster cargo, which will go to Collingwood.

The D. & C. Co. is ready to open navigation, its steamers City of Detroit, and City of Cleveland, having been completely overhauled. Navigation between the two cities will open as soon as the weather makes it possible, which will be in a few days. As soon as the new steamer City of Cleveland comes out, the present City of Cleveland will go on the Mackinac Island run under her new name, City of St. Ignace.

L. C. Waldo, manager of the Northwestern and Roby Transportation Companies, has returned to Detroit from his trip abroad. Mr. Waldo's pleasure was marred by a painful accident which befell him while crossing the English channel. He was thrown to the deck of the vessel a small bone in his right leg was broken. He is, however, recovering rapidly. Mr. Waldo was accompanied on his trip abroad by W. A. Prime, of New York.

General Manager Schantz, of the D.

& C. line has appointed Capt. John Lightbody as master of the steamer City of St. Ignace and Capt. Eugene Hayward as master of the steamer State of Ohio. For several years Lightbody has been pilot on the steamer City of Cleveland and Hayward pilot on the steamer Eastern States of the D. & B. Line. Peter Shaughnessy will act as pilot of the steamer City of Detroit under Capt. Archibald McLachlan.

J. W. Norcross, Port Colborne, Ont., has given an order to Wm. Dobson & Co., Newcastle-on-Tyne, England, for a steamer of Canadian canal dimensions. The steamer will be 256 ft. over all, 43 ft. beam and 26 ft. deep. Her engines will be triple-expansion with cylinders 19, 32 and 52 in. diameters by 36-in. stroke. She will have a double deck with six hatches on the upper deck and seven hatches between decks, with three gangway doors on each side.

The river and harbor bill carries appropriations for several lighthouses to be erected on the great lakes, one on White Shoal, Straits of Mackinaw, at a cost of \$150,000; another at Split Rock, north shore of Lake Superior, at a cost of \$75,000, and a third at Rock of Ages, Lake Superior. An appropriation was also secured for a light-ship for the easterly end of North Manitou Island, Lake Michigan, but the effort to secure an appropriation for a lighthouse on Gull Island failed.

Supt. Charles Morton of the twelfth life saving district has received orders from Washington relative to the Holland life saving crew which had been under fire since the breakwater incident of last November when four men lost their lives in a storm within a few hundred feet of the station without proper effort being made to rescue them. Supt. Morton's orders are to keep only Robert C. Smith of Holland. He was not present at the early hours of the crib affair, but was praised for the work he did later.

The Welin Quadrant Davit, Whitehall Bldg., 17 Battery Place, New York, have just issued new folders descriptive of their davit and also of the Mills Engaging & Disengaging Gear for lifeboats. The descriptions are quite complete and well illustrated, and will be mailed to anyone requesting them.

Among the boilers for export sold to New York exporters by the Roberts Safety Water Tube Boiler Co. recently are one for Messrs. Hungerford Bros. & Co., and one for Messrs. Fox Bros. & Co.

QUESTIONS FOR WHEELSMEN AND WATCHMEN.—NO. 35.

356. Give correct magnetic course and distance from a point one mile south of Poverty island lighthouse to a point $\frac{1}{2}$ mile S x W from Eleven Foot shoal lightship.

357. Give correct magnetic course and distance from a point $\frac{1}{2}$ mile S x W from Eleven Foot shoal lightship to a point $\frac{1}{2}$ mile east from Sand point lighthouse, Escanaba.

358. Give correct magnetic course and distance from a point one mile south of Poverty island lighthouse to a point $\frac{1}{2}$ mile S x W from Eleven Foot shoal lightship, passing between St. Martin and Gull islands.

359. Give true course and distance from a point one mile south of Poverty island lighthouse to entrance Menominee harbor via Rock island passage.

360. Give true course and distance from a point one mile south of Poverty island lighthouse to a point two miles west of Chambers island lighthouse passing through Death's Door passage.

361. How would you pilot a boat from a point four miles SE x S from Pilot island lighthouse to a point one mile NW, from the NW end of Plum island?

362. When the NW end of Plum island bears SE, distant one mile, give correct magnetic course and distance to Escanaba.

363. When the NW end of Plum island bears SE, distant one mile, give true course and distance to buoy at entrance of Fox river.

364. Give true bearing of Plum island ranges.

365. In what part of Lake Michigan is the deepest sounding marked on chart of 1905?

QUESTIONS FOR MASTERS AND MATES.—NO. 34.

500. What is meant by the equation of time?

501. What is the difference between apparent time and mean time?

502. How would you find apparent time from mean time?

503. What is standard time?

504. How many standard time belts are there in the United States?

506. What standard time belt is Buffalo in?

507. What meridian is her standard time based upon?

508. Is the apparent day ever 24 hours in length according to mean time?

509. What is meant by mean time?

510. How much difference can there be between mean and apparent times?

APPOINTMENTS OF MASTERS AND ENGINEERS.

CAPTAIN.

ENGINEER.

		GUS KITZINGER, MANISTEE, MICH.	
Str.	Pere Marquette No. 3	H. L. Sanders	Ed Hineline
"	Pere Marquette No. 4		J. Reardon
"	Pere Marquette No. 6	Mike Martin	V. Johns
"	R. C. Wentz	Ed Skeels	Herman Winkler
"	John Schroeder	Ed Staffelbeam	Robert Thielman
"	Hattie	Chas. Tonkon	Chas. Christenson
		JULIUS KROOS, SHEBOYGAN, WIS.	
Str.	Susie Chipman	N. A. Gunderson	J. N. Burns
		LAKE ONTARIO & BAY OF QUINTE STEAMBOAT CO., KINGSTON, ONT.	
Str.	North King	John J. Jarrell	George Boyd
"	Caspian	William Bloomfield	D. J. Leslie
		THE CLEVELAND TRANS. CO., CLEVELAND, O.	
Str.	E. A. Shores Jr.	George J. Sauer	
		J. J. BROWN, BUFFALO, N. Y.	
Str.	Lackawanna	Robert Young	Peter Collins
"	Scranton	H. W. Stewart	F. D. Fredericks
		THISTLE TRANSPORTATION CO., GRAND HAVEN, MICH.	
Str.	Pentland	Thomas McCambridge	Hugh Mulligan
		M. J. LYNN, BAY CITY, MICH.	
Str.	Lizzie Madden	Ralph Pringle	G. McLellan
		JERRY MCCARTHY, BUFFALO, N. Y.	
Sch.	Iron City	John Barclay	
"	Grace Holland	M. Nagle	
		M. B. McMILLAN, DETROIT, MICH.	
Str.	Admiral	M. G. McIntosh	George Purvis
"	W. K. Bixby	J. H. Ivers	P. J. McCabe
		MAHONING STEAMSHIP CO., CLEVELAND, O.	
Str.	Powell Stackhouse	William Megarvey	John Groundwater
"	L. C. Hanna	M. Anderson	George Averill
		MANITOU STEAMSHIP CO., CHICAGO, ILL.	
Str.	Manitou	William T. Bright	B. F. McCanna
		MARINE TRANSPORTATION CO., OGDENSBURG, N. Y.	
Str.	Nipigon	John Goodrich	James Purvis
Sch.	Middlesex	A. Grandee	
		THOMAS MARKS & CO., PORT ARTHUR, ONT.	
Str.	Neebing	John Ewart	Arthur F. Foote
		MARQUETTE & BESSEMER DOCK & NAVIGATION CO., CONNEAUT, O.	
Str.	M. & B. No. 1	M. M. Rowan	Robert Leitch
"	M. & B. No. 2	R. R. McLeod	E. Wood
		MATHEWS LINE, TORONTO, CAN.	
Str.	Haddington	James Delaney	Hedley R. Welch
"	Edmonton		William Harman
		CAPT. A. T. MAY, DETROIT, MICH.	
Str.	Emerald	A. T. May	William Galpin
		C. H. STARKE, MILWAUKEE, WIS.	
Str.	Christopher		McDougal
		MICHIGAN CENTRAL R. R. CO., DETROIT, MICH.	
Str.	Detroit	John C. Craig	D. A. Black
		George D. Horn	
"	Transfer	William King	A. O. Borton
		A. J. Huntoon	
		MICHIGAN, INDIANA & ILLINOIS LINE, CHICAGO, ILL.	
Str.	John Oades	H. M. Boyce	Eugene Hidden
"	Marion	H. J. Nelson	C. G. Olson
"	Normandie	Andrew Olsen	Richard Winkler
		J. B. MILLER, TORONTO, CAN.	
Str.	Seguin	Jos. Welson	Robert Marshall
		D. W. MILLS, CLEVELAND, O.	
Str.	Sparta	Dan Warwick	E. J. Moore
Sch.	Alex Anderson	J. K. Edwards	
"	Biwabik	H. S. Hughes	
		CLEVELAND & BUFFALO TRANS. CO., CLEVELAND, O.	
Str.	City of Erie	Hugh McAlpine	J. Y. Rendall
"	City of Buffalo	W. H. Smith	Charles Lorimer
		MUTUAL TRANSIT CO., BUFFALO, N. Y.	
Str.	Northern King	E. C. Leath	A. Nagelvoart
"	Northern Queen	W. H. Stevenson	O. J. McGinnis
"	Northern Wave	D. L. Cartwright	J. J. Darcy
"	Northern Light	S. B. Worden	J. J. Dee
"	North Wind	E. B. Blair	T. W. Jackman
"	North Star	George Hayward	W. T. Pike
"	Minneapolis	Walter Robinson	D. J. McMillan
"	St. Paul	Peter Thompson	Henry Stone
"	Huron	Neil Anderson	Alex Adams
"	William Castle	George B. Crawford	G. A. Hemenger
		CHARLES S. NEFF, MILWAUKEE, WIS.	
Str.	Charles S. Neff	John A. Doak	Stephen L. Newnham
		C. MC G. KOCH, SANDUSKY, O.	
Str.	Annie Laura	D. O. Lockhart	Jerry Shampaign
		ARNOLD TRANSIT CO., MACKINAW ISLAND, MICH.	
Str.	City of Kalamazoo	William McCarty	Patrick Eustice
"	Elva	William J. Stewart	John Harrington

NAUTICAL ASTRONOMY SIMPLIFIED.

Some Useful and Interesting Facts About Polaris and the Big Dipper.

BY CLARENCE E. LONG.

PREFACE:

THE OBJECT OF THIS ARTICLE IS TO CALL THE ATTENTION OF LAKE CAPTAINS AND OTHERS TO THE USEFULNESS OF OBSERVING FOR AZIMUTHS, OBSERVING STARS FOR AZIMUTHS IN ASCERTAINING THE DEVIATION OF THE COMPASS, OR IN SETTING THE COURSE, CANNOT BE TOO STRONGLY RECOMMENDED. IT IS OF INESTIMABLE VALUE TO KNOW HOW TO USE THE STARS FOR AZIMUTH PURPOSES. THE SUN MAY BE OVER-CLOUDED FOR SEVERAL DAYS WITH CLEAR NIGHTS SO THAT THE STARS READILY AFFORD A MEANS OF FINDING THE DEVIATION AT ANY HOUR OF THE NIGHT, THE SAME AS USING THE SUN DURING THE DAY. THE STARS CAN BE USED FOR THIS PURPOSE ALMOST AS EASILY AS THE SUN, THERE BEING ONLY A FEW ADDITIONAL POINTS TO KNOW AND BEAR IN MIND. THE MOON CAN BE USED IN THE SAME MANNER. THE CAPTAIN OF TODAY (ON ACCOUNT OF THE PECULIAR BUILD OF LAKE BOATS) CANNOT MAKE COURSES IN CLOUDY WEATHER SINCE IT IS ALMOST NECESSARY FOR HIM TO RELY SOLELY ON AZIMUTHS OF THE SUN FOR EVERY COURSE HE STEERS. THE STARS THEN WOULD PROVE OF THE GREATEST VALUE TO HIM, SINCE IT INVARIABLY HAPPENS THAT A CLOUDY DAY BRINGS FORTH A CLEAR NIGHT.

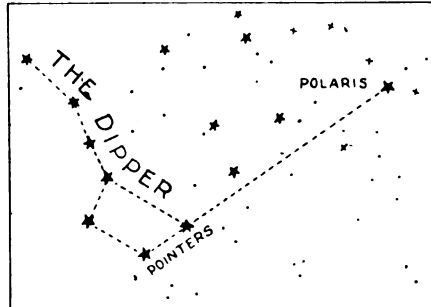
THERE ARE MASTERS WHO WILL LOOK ON THIS ARTICLE WITH SUSPICION, AND THEY WILL SAY TO THEMSELVES THAT IT IS TOO HEAVY FOR THEM. RIGHT HERE IS WHERE THEY ARE MISTAKEN. THIS SUBJECT IS NOT BEYOND THE ATTAINMENTS OF THE AVERAGE LAKE MASTER AND HE SHOULD NOT BE SATISFIED WITH HIMSELF UNTIL HE HAS MASTERED IT. HOW TO FIND THE STARS WILL BE EXPLAINED IN ANOTHER PAPER. IT IS NECESSARY TO UNDERSTAND WHAT IS EXPLAINED IN THE FOLLOWING ARTICLE BEFORE "STAR FINDING" CAN BE ACCOMPLISHED WITH ANY DEGREE OF SATISFACTION.

THE NORTH STAR OR POLE STAR.

Of all stars the North Star is probably the most useful to the navigator of the northern hemisphere. This is because it is practically stationary in the northern sky, its orbit of revolution being so small that any motion of the star is made imperceptible to the casual observer. All the other stars appear to move, and keep changing their positions and bearings, much like that of the sun. Not so with the North Star, it will always be found in the northern sky practically in the same place. It is for this reason that it is the mariner's unerring guide, and many a disaster has been averted by

its timely bearing, and many is the lost traveler who has regained his reckoning from this star at "roost."

This remarkable feature of the North Star affords the standard by which all terrestrial directions are determined, for it is only necessary to get a bearing of this star on any clear night to establish the true north or the true meridian of any place. No other celestial body affords this simple means of determining actual directions. Little or no calculation is required to use the north star in this respect, whereas, with all other stars, also the moon and the sun, require computations more or less difficult. The earth's rotation and the rising sun afford us the direction of east, but only twice



in the year (at the equinoxes) does the sun rise exactly in the east. It is therefore more convenient and much more reliable, to reckon direction from the north, which can be accurately determined by observations of the North Star, or Polaris, a fixed star situated almost directly over the north pole, and, therefore, a true index of north. For this reason it is often called the Pole Star. This star is of course only visible at places north of the equator, and can be found any clear night by reference to two stars, called "the pointers," in the constellation of "The Big Dipper."

Twice during every 24 hours the Pole Star is at its greatest angle from the true north pole of the heavens, called celestial pole. This greatest angle is but $1^{\circ} 11'$. At all other times it is less than this, and twice in 24 hours it bears true north—once when above, and once when below the true pole. In other words, the star bears true north when it intercepts the pole (called above the pole) and true north when it is intercepted by the pole (called below the pole).

From the above it will be appreciated that the star never varies more than the eleventh part of one compass point from

the true north, therefore it is safe to consider the star as indicating the true pole of the heavens, for it would require fine manipulation to detect a variation at any time.

In astronomy this star is referred to as Ursa Minoris, and before it became the pole star it was known as Ruccabah. the Dipper, which affords an infallible guide to the pole star by means of the two "pointers," is in the constellation of Ursa Majoris, and the Pole Star is in the tail of the Little Dipper or Little Bear. Ursa Minoris means the Little Bear, also referred to as Ursa Minor; Ursa Majoris (Ursa Major) means Great Bear.

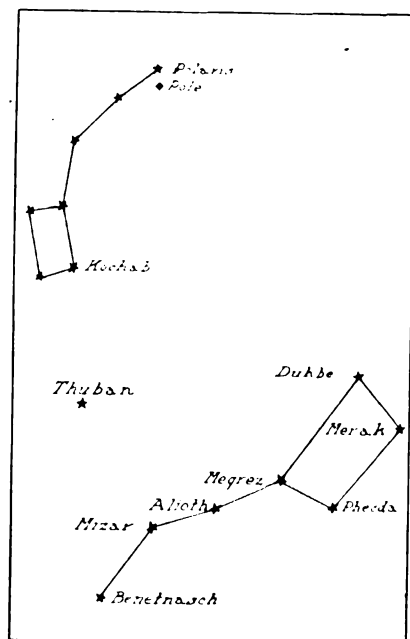
The Great Bear or Big Dipper, as it is best known, is a constellation remarkable for its conspicuousness, and it is due to this fact that it is so easily found. The figure formed by its seven principal stars is variously termed—the Plough, the Skillet, the Cleaver, the Dipper, the Wagon, and Charles's Wain. This constellation is more deserving of such names than that of "Great Bear." That this constellation looked like a great bear to the ancients is beyond the comprehension of we of today. The observer of today finds it impossible to trace in the sky the various figures which groups of stars were supposed to represent by the astronomers of the olden time. The Great Bear has an impossible tail for a bear. Who ever heard of a bear having a tail longer than its body. Therefore, the Great Bear makes an infinitely better plough, dipper, etc. While most people would absolutely fail to recognize such fanciful images as the crow, the eagle, the whale, the dog, the ship, the ram, the lion, the dove, the swan, the crane, the sea serpent, the fish, the scorpion, the giant, the virgin, and a hundred or more others, equally as ridiculous, but they could not help but perceive, on the most casual inspection, that certain star groups had forms, mostly geometrical, of some kind or another. This being so, it is more satisfactory and much more convenient, to know them as some such figure. For this reason it is better at once to chuck over these fantastic figures as so much imaginary rubbish.

The Big Dipper is composed of seven stars of nearly equal brightness, and this is what renders it so easily recognized by the learner.

The star at the extreme end of the handle of the Big Dipper is named Benetnasch. The two at the opposite, or

leading end, of the Dipper are termed the "pointers," because a line through them, if produced, will pass close to the North Star—which, by the way, is the best means of finding it. The two stars comprising the pointers are named Dubhe and Merak, Dubhe being nearer the North Star than Merak. With the exception of the Pole Star and the "Guards," the stars comprising the Little Bear are faint, and at times somewhat difficult to make out.

There are points of similarity and dissimilarity between the two Bears. Each has seven principal stars: four of them form an irregular square, and the remainder a tail, or more like it, a handle. The dissimilarity consists in the handles



LITTLE AND BIG DIPPERS—BELOW THE POLE
LOOKING NORTH.

having opposite curvatures; that of the Big Dipper droops, while the other turns up. Again, the figures are different as regards size; and lastly, the magnitudes in the one case are fairly uniform as compared with the poverty of the bulk of them in the other. Polaris, or the North Star, is in the extremity of the handle of the Little Dipper, just as Benetnasch is in the extremity of the handle of the Big Dipper. The "pointers" in the Big Dipper correspond to the "Guards" in the Little Dipper.

The two middle stars in the handle of the Big Dipper face the "Guards," the four forming a narrow oblong, with Thuban (a Draconis) lying midway as a sort of faint connecting link between the two constellations or groups of stars.

About 2,300 B. C. Thuban was the Pole Star, and bore $\frac{1}{4}^\circ$ distant from the true pole. The Pole Star is approaching the Pole, and about the year 2,014 it will be within $\frac{1}{2}^\circ$ of it. It will then commence

to recede, and 12,000 years from now Vega will be the Polar Star. These changes arise from what is known as the "precession of the equinoxes"—which means the shifting of the equinoxes towards the west.

Polaris is a star of the second magnitude, and is computed to be 245 billions of miles from the earth. This means a light journey of 42 years. The velocity of light is about 186,000 miles per second. Think of the distance that light will travel in just one day, then a year.

At the building of the great pyramid of Gizeh, about 4,000 years ago, Draconis was the pole star; being at that time distant in angle from the pole $3\frac{3}{4}$ degrees. A remarkable fact in connection with the building of all the pyramids of Gizeh is that the narrow passages by which alone they can be entered, all open out on the north faces of the pyramids, and these passages are inclined at an angle which admitted of the then pole star (Draconis) to be visible to the observer stationed at the bottom of the passages.

The Pole star is not only particularly accommodating in affording seamen a ready means of determining the chief cardinal direction, but also affords him a ready means of calculating his latitude at any hour of the night. This invaluable guide is now but a degree and eleven minutes distant from the pole of the heavens; and as the diameter of its daily circle ($2^\circ 22'$) is small in consequence, the star's apparent revolution round the pole is very slow, being only about a minute of arc ($1'$) in three minutes of time. This enables observations for latitude to be made regardless of whether it is on or off the meridian, as an error in the time used in the computation—unless very considerable—has but little effect on the result.

Were the North star directly over the true north pole of the earth, or were it to occupy the exact position of the celestial pole, it would be a fixed point, and its altitude, when corrected for dip and refraction, would be equal to the latitude of the observer; in other words, if you were in latitude 44° the star would be 44° above your horizon. Its declination would then be 90° , instead of $88^\circ 49'$ ($90^\circ - 1^\circ 11'$).

When we wish to define our position on the earth's surface we resort to latitude and longitude; the one giving a north and south, and the other an east and west direction. In like manner, to ascertain the whereabouts in the heavens of any particular body, we must know its Declination and Right Ascension. While longitude and right ascension are similar there are points of difference, which is explained farther on. The declination of a heavenly body is its angular distance north or south of the equi-

noctial. What the equator represents on the earth, the equinoctial represents in the sky. Declination is celestial latitude, right ascension, celestial longitude. When we say that a star has a declination of 50° we mean that its angular distance from the equinoctial is 50° , or 40° from the celestial pole. If we say our latitude is 50° , it means 50° from the equator or 40° from the true pole, known as polar distance. Latitude is measured on a meridian of longitude, hence a meridian of longitude produced till it reached the apparent sky, or celestial concave, corresponds to a circle (great) of declination. Longitude is measured on the equator or on a parallel of latitude. Longitude is measured from a certain meridian eastward or westward, while celestial longitude or right ascension, is reckoned eastward, the former from 0° to 360° and the latter from 0h to 24h.

A parallel of latitude on the earth corresponds to a parallel of declination in the sky. Such a circle on the earth marks all places having the same angular distance north or south of the equator. A parallel of declination marks all celestial bodies having the same angular distance, north or south of the celestial equator, or equinoctial.

The celestial concave, or the heavens, is the surface of an infinitely large sphere of which the observer's eye is the center, and on which the motions of the heavenly bodies appear to take place. Or, the sky as it appears to the eye, constitutes a sphere surrounding the earth. The heavenly bodies are not in reality thus situated with respect to the spectator; for they are interspersed in infinite space at very different distances from him. The whole is an optical deception, by which an observer, wherever he is placed, is induced to imagine himself to be at the center of the universe.

The earth rotates on its axis daily. The ends of the axis are the true poles of the earth. If the true poles of the earth were produced to infinity their ends would be the true poles of the heavens, therefore, the true poles of the heavens are imaginary points situated directly above the true poles of the earth, or what the true poles are to the earth, the celestial poles are to the heavens.

We say that the sun revolves around the earth and the stars around the pole. They appear to but they don't for it's the earth's rotation that makes them appear to, and nothing else. The stars are fixed; they don't move according to our method of reckoning direction. We say the north star is approaching the pole, whereas, we should say that the pole is approaching the star, by reason of precession, or the "slippage" of the earth in its rotation.

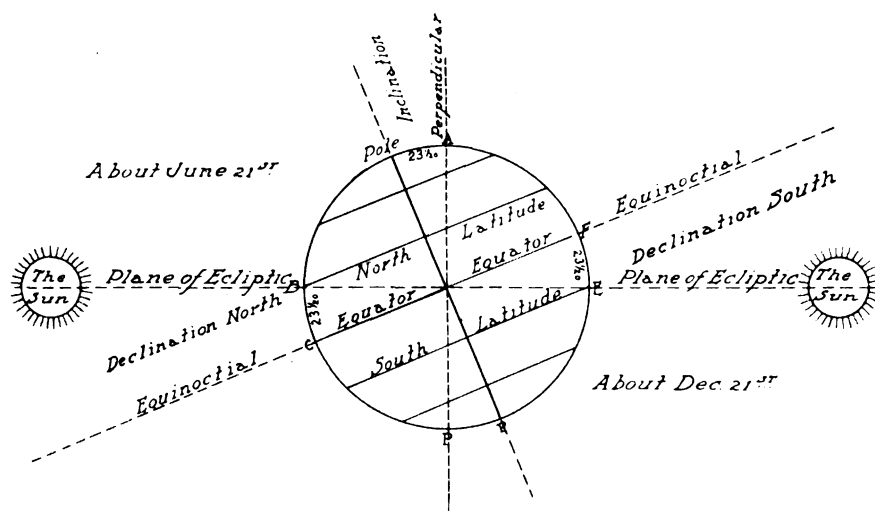
In high latitudes certain stars (like those in the two Dippers) complete their daily revolution around the pole of the heavens without rising or setting and as a consequence are called Circumpolar Stars. The stars comprising the Big and Little Dippers are therefore circumpolar stars for they revolve around the pole without rising or setting. This occurs when their polar distance (their declination subtracted from 90 degrees) is less than the latitude of the observer—both being of the same name. These stars, the same as the pole star, having come to the meridian above the pole, which is their highest point, decline towards the westward for six hours, when

the world, but his time as shown by our clocks and watches, isn't accurate, and neither can any watch or clock keep time by him. That is to say, if you were to set a good time piece to XII o'clock the moment the sun was on your meridian (when it bore true south) the time it will be on the meridian next day would not be exactly 12 o'clock again, as you might imagine; that is, the time elapsed between transits, would not be precisely 24 hours. It might be after 12 and it might take place before 12, that is, it may have taken the earth (according to the apparent motion of the sun), more than 24 hours to make a complete rotation on her axis, or it may have

perpendicular (the perpendicular is at right angles with the plane of the earth's orbit), so that the earth in moving forward in its path and all the time rotating on its axis, does not present the same surface to the vertical rays of the sun; in other words, the sun does not describe the same path at the same place from day to day, therefore the fluctuations in the sun's real time. This is also what gives rise to the variety of seasons, and makes the sun appear, as the earth travels around it, to go north and south, called the sun's declination.

To overcome this variation in the sun's real time, which is called apparent time, mean or average time is made use of. The length of this unit is the average length of all the apparent (true) solar days for the period of a solar year. The mean solar day is divided into twenty-four equal parts, the same as every kind of day, whether apparent solar or sidereal. While the unit remains the same, it takes a longer or a shorter time for a time piece to "reel" off these hours. If we regulated a time piece to keep pace with the sun the four days or times in the year that it returns to the meridian successively between the same intervals of time, and divide the unit into twenty-four equal parts we will have an exact measure of mean time. If we then timed the sun by this time piece at the precise interval across the same meridian for one solar year, and then added the various elapsed times together and divided the sum by the number of days in the solar year we would get 24 for an answer. We would find that some days it took less than 24 hours for the sun to return to the meridian it started from, and other times more than 24 hours. Apparent time is sometimes as much as 16 minutes behind mean time, and some times as much as $14\frac{1}{2}$ minutes ahead of mean time. The equation of time does not increase and decrease uniformly throughout the year, for the same reason that the length of the solar days are unequal, both because the motion of the earth in its orbit is variable, and because the plane of the orbit is not perpendicular to the axis of rotation.

Mean time begins (that is, a mean solar clock points to oh. om. os.) at mean noon; or what is the same thing—at the instant of the passage of the imaginary sun across your meridian. This time is uniform since it presupposes the sun to be on your meridian at exactly 12 o'clock noon every day in the year. The apparent noon occurs when the real sun is actually on your meridian, no matter what your mean solar clock may say. Apparent noon is the instant when the navigator can most easily and expeditiously determine his latitude by an altitude of that body. The sun reaches



The above diagram will explain itself. The sun shines on but one-half the earth at any time. The lighted half of the earth at any time is that portion which happens to be at right angles to the plane of the ecliptic. It is measured from the vertical ray of the sun. Therefore, when the sun shines beyond one pole it falls short of the other pole by the same amount. The sun remains in its one position and the earth rotates on its axis retaining the same position, but owing to the elliptical path of the earth around the sun, the axis in retaining this fixed position the earth must present different parts of its surface to the sun daily. The various diagrams show the extremes of these conditions. During the time between these periods the sun does not shine so far beyond one of the poles, but somewhere in between the extremes.

they gradually curve eastward—still falling, however,—till in another six hours their lower culmination is reached, when they are said to be on the meridian below the pole.

They then commence to rise, still moving eastward, for another six hours, after which they turn to the westward in their upward course for a further period of six hours, when the circle is completed, and they are again on the meridian above the pole. The hours here mentioned are not the kind of hours that we measure time by, that is, they are not sun or solar hours, but sidereal hours, that is, star hours, or star time. Star hours are nearly ten seconds shorter than mean solar ones. This is equal to saying that if any star was on your meridian at a certain hour by sidereal time, that 12 hours thereafter, it would again be on the meridian.

In the language of nautical astronomy, the earth (for sake of convenience) is considered as standing still, and the heavens to be moving around it.

The sun is the great time keeper of

taken less than 24 hours. It will all depend on where the earth is in its orbit (the path it describes in its annual movement around the sun). Four times in the year (that is, the earth in four positions in its orbit) the sun and your watch would be together—this occurring about April 15th, June 15th, Sept. 1, and Dec. 24. The reason that the sun's real time is variable is because of the inclination of the earth's axis to the plane of its orbit and that the earth in moving forward in its orbit, which is elliptical, can not travel uniformly at all times. The earth rotates on its axis at a uniform speed throughout the year so that it takes precisely the same time for it to make each complete rotation.

In the annual motion of the earth, its axis preserves, at all times, the same direction as if the orbital motion had no existence; and is carried around parallel to itself, and pointing always to the same vanishing point in the sphere of the fixed stars. This vanishing point is the celestial pole. But the earth's axis leans $23\frac{1}{2}$ degrees out of the per-

its highest point (on the meridian) in the sky at the instant of apparent noon, and the measured altitude by sextant determines this point. At sea the navigator has his chronometer regulated to mean time of the meridian of Greenwich, his reckoning point for time and longitude. If a computation at sea requires the navigator to know the mean time at ship he turns his longitude into time and subtracts it from chronometer (Greenwich) time if in west longitude, and adds it if in east longitude. If he desires the apparent time all that is necessary is to find the equation of time from the Nautical Almanac for his date and apply it to his mean time. If he should desire the mean time from his apparent time he can find it by the reverse operation. The equation of time is itself a portion of mean time.

Since the earth rotates on its axis at a uniform rate of speed throughout the year, the interval between two transits of the same spot on the earth over some imaginary but stationary point in the sky would then be always the same, and an exact measure of time. The sidereal day conforms to the two transits mentioned and the correct measure of time is, therefore, sidereal time. The word sidereal means—of or belonging to the stars. Sidereal time is divided into twenty-four hours the same as mean and apparent solar time, but its hours do not conform to mean solar or apparent solar hours.

A sidereal day is the period in which the earth performs one complete revolution round its axis, and, setting fractions on one side, is equal to 23h. 56m. 4s. of mean time, as measured by our clocks or watches; so that the common expression, that the earth rotates on its axis once in 24 hours, is incorrect, unless sidereal hours are either specified or understood.

The reason that it is called sidereal or star time is because the stars according to this time come to the meridian at exactly the same time, that is, if a star is on your meridian at a certain hour of sidereal time, 24 hours thereafter, it will be back on your meridian; therefore, the stars keep pace with the rotation of the earth, and their revolution in the heavens may be taken as perfectly regular. Now, why is it that the stars are regular and not so with the sun? It is because the stars are at such inconceivable distances from the earth that the earth's annual motion in space around the sun is quite imperceptible when compared with them. Unlike the sun, the non-coincidence of the equator with the ecliptic, and the unequal motion of the sun in the latter, due to the eccentricity of the earth's orbit, the earth's erratic motion can have no such influence on the stars as it has with the sun. A sidereal day is shorter than a

mean solar day by 3m. 56s.; consequently, the stars come to the meridian of any place nearly four minutes of mean clock time earlier on each succeeding day.

The sidereal year does not commence the first of January like the solar year, and neither does the sidereal day begin

nox when its declination changes from south to north; or, as sailors say, when the sun crosses the line bound north. This point, like the mean sun, is purely an imaginary one, as nothing exists to mark its place, nor would it be any particular advantage were it otherwise; moreover, the point itself is liable to a

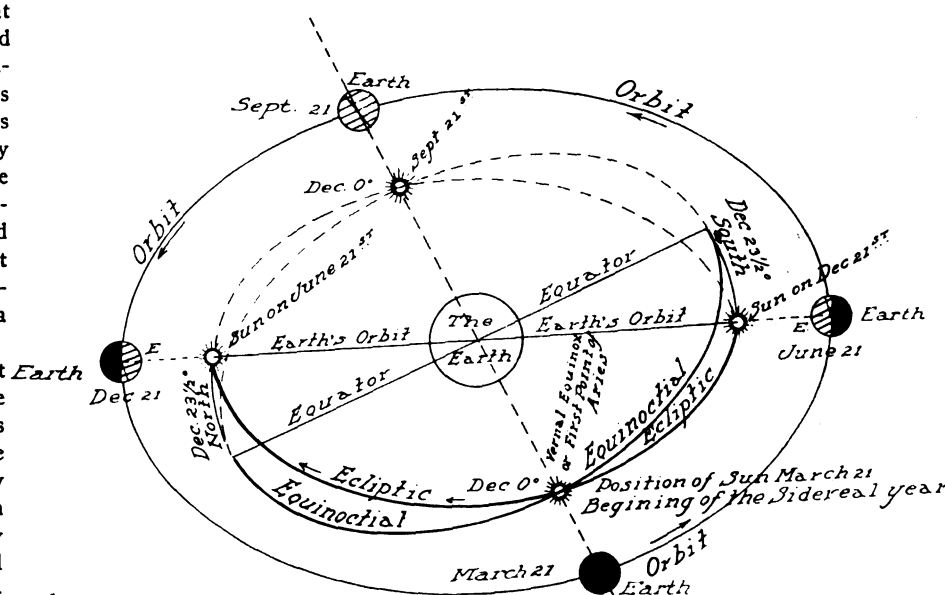


Diagram showing the earth in the four important positions in its orbit or annual path around the sun. This is shown by the outside circle and figures. If we assume that it is the sun that moves and not the earth, the orbit becomes the ecliptic, as shown by the central figure. Under this condition the sun instead of the earth is shown in four important positions in its ecliptic or annual path around the earth. The sun at these times occupies the same position in its ecliptic as the earth does in its orbit. If we could view the earth from the sun we would find it traveling round us as shown by the outer ellipse, but as we view the sun from the earth, we find the sun apparently describing the path known as the ecliptic. Therefore, the earth's orbit and the sun's ecliptic are one and the same thing. In the one case we must assume the sun to be stationary while the earth revolves around it, and in the other case we must assume that the earth does not revolve, but it is the sun that moves. It is for this reason that the sun in the ecliptic for Dec. 21 conforms to the position of the earth in its orbit on June 21. The earth's orbit is its real revolution around the sun, while the ecliptic is the apparent path described by the sun around the earth during the same time.

The equinoctial is a great circle in the sky like the equator is a great circle on the earth. These two circles correspond and coincide with each other, for what the one is to the earth the other is to the heavens. The earth's orbit or the sun's ecliptic is another great circle in the heavens just like that of the equinoctial or celestial equator. But owing to the inclination of the earth's axis to the plane of its orbit, or the plane of the ecliptic, which is all the same thing, these two great circles do not coincide with each other, but cross at two points diametrically opposite. All great circles bisect each other; they must, since they have the same center. The equinoctial and ecliptic have the same center, the center of the earth being the point or vertex. Bear in mind that the inclination of the earth's axis is always the same with the plane of the ecliptic (23½ degrees). So, too, does the angle between the equinoctial and ecliptic remain always the same (23½ degrees). This 23½ degrees represents the greatest distance these two circles are separated from each other, hence, the limits of the sun's declinations, and the real cause of declination. The two points where these great circles bisect each other must occur directly over the equator, hence the angle there must be zero. When the earth in its orbit or the sun in its ecliptic occupies either of these positions, the sun must be directly over the equator, and at that time his declination must be zero. These intersecting points are also called the equinoxes on account of when the sun occupies either one of them, the days and nights are of equal length all over the world. When the sun occupies the position at the intersection of the equinoctial and ecliptic (the vernal or March equinox), the sun, earth, and the First Point of Aries, are all in the same true line. It is at this time that the sidereal year begins. The vernal equinox remains fixed at this position of intersection, but the sun moves away from it as it travels round in its ecliptic. As the earth rotates and brings this point successively over the same meridian, accounts for the beginning and ending of the sidereal day. When the sun reaches its position in the ecliptic for June 21, or thereabouts, the sun and this point have separated 90 degrees, or 6 hours, or the sun's apparent right ascension is 6 hours. Six months later they will be 180 degrees, or 12 hours apart, on Dec. 21 18 hours, and on March 21, 24 hours apart.

with the solar day, nor is sidereal noon solar noon, mean or apparent.

Sidereal time begins (that is, a sidereal clock points to oh. om. os.) when the first point of Aries is on the meridian of the observer, and is counted straight through 24 hours till the same point returns again.

It is now necessary to know what is meant by the first point of Aries. It is that point in the heavens which the sun's center occupies at the March equi-

certain slow movement westward, owing to precession.

Aries (Latin for Ram) is the constellation known as the Ram, and is one of the signs of the zodiac. It used to contain the first point of Aries, but owing to the precession of the equinoxes, this imaginary point has now retrograded into the constellation Pisces, but, nevertheless, its original position is made to answer the same thing in imagination, so that it in no wise affects the calculations of sider-

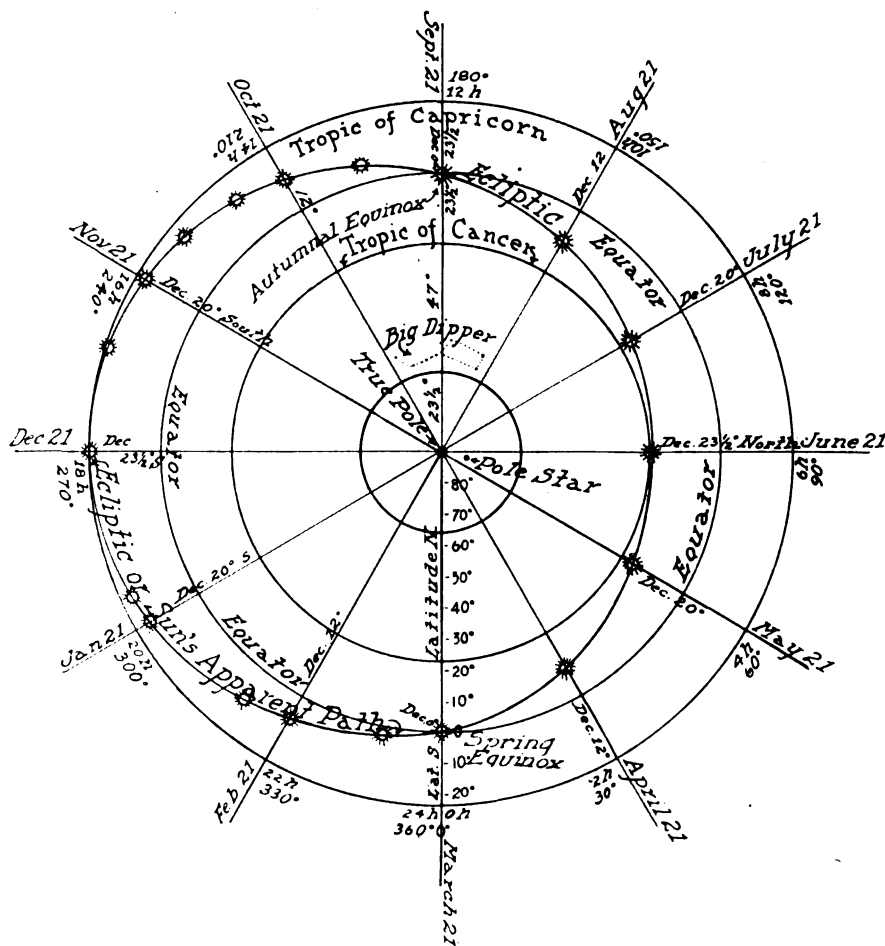
real time and the right ascensions of the stars, the sun and the planets.

Since the imaginary first point of Aries corresponds to the vernal or spring equinox, it will be more simple and therefore more convenient to mention it as the vernal equinox instead of the first point of Aries. Roughly speaking, sidereal time is measured by the daily motion of the stars; but to be precise, it is measured by the daily motion of that point in the equator from which the true right ascensions of the stars are counted, but it amounts to the same thing. The point in question is the vernal equinox, and its hour angle is always the sidereal time. Astronomical clocks are usually regulated to sidereal time, and are then called sidereal clocks.

Therefore the sidereal year begins at the instant that the sun occupies the vernal equinox in March. A sidereal day is the interval between two successive transits of the vernal equinox over the same meridian—equal to one absolute rotation of the earth. It is 3m. 55.9s. of mean solar time shorter than the mean solar day, the tropical year of 365.24 solar days, being divided into 366.24 sidereal days, each comprising 24 sidereal hours. The sidereal hours are counted from 0 to 24, commencing with the instant of the passage of the true vernal equinox over the upper meridian, and ending with its return to the same meridian. About March 23 of each year the sidereal clock agrees with the mean time or ordinary clock, and the former gains on the latter 3m. 56.5s. of sidereal time per day, so that the end of a year it will have gained an entire day, and will again agree with the mean time clock.

Sidereal noon is the instant that you have the vernal equinox on your meridian. This may occur at any time of the day or night according to the mean time clock, but with a clock regulated to sidereal time it would occur at the same instant of time, which would be 24 o'clock, but with our mean solar time it would take place about 4 minutes earlier every day.

Now, let us get the correct idea of what Right Ascension is. Right ascension is nothing more than sidereal time. Imagine you have a clock regulated to sidereal time. Since sidereal time is reckoned through 24 hours from west to east, the dial of such a clock is divided into 24 equal parts instead of 12 as the ordinary clock shows. We will start with the beginning of the sidereal year, say, that is, when the sun and vernal equinox are in one, start the sidereal clock, which had previously been set to oh. om. os. to going. Now, it is plain to be seen that when the earth has made one rotation and brought you and your meridian back to the same point of this



Another view of the ecliptic, showing the points of intersection with the equator and the two tropics. In consequence of the inclination of the earth's axis to the plane of the orbit, the plane of the ecliptic is inclined to the plane of the equator at an angle of $23\frac{1}{2}$ degrees, and as the sun moves along in the ecliptic it travels vertically over that portion of the earth's surface lying $23\frac{1}{2}$ degrees north and south of the equator. Hence, these parallels of latitude on the earth are taken as the limits of the hottest or "torrid" zone. The parallel on the north is called the tropic of Cancer, and the one on the south the tropic of Capricorn. They are called tropics (turnings), because over them the sun appears to turn and retrace his course toward the equator.

From the various positions of the sun in the ecliptic the cause and principle of the sun's declination become matters of simplicity. Starting from either of the equinoxes, where the declination is zero, it is plain to be seen that as the sun moves forward in the ecliptic that it gets farther and farther from the equator, from where it is measured. When it reaches either of the tropics it has reached its extreme limits, $23\frac{1}{2}$ degrees, the same amount that the earth's axis is inclined from a perpendicular line. When the sun has moved along in the ecliptic so that it is vertically over the tropic of Cancer at noon, summer commences in the northern and winter in the southern hemispheres. The declination is then $23\frac{1}{2}$ degrees north. It is north from about March 21 to about Sept. 21. When the sun has moved along in the ecliptic till it is vertically overhead for those in the latitude of $23\frac{1}{2}$ degrees south, it is then over the tropic of Capricorn, and has reached its extreme southern limits. It is the beginning of summer in the southern hemisphere and the beginning of winter in the northern hemisphere. The sun's declination increases from zero to $23\frac{1}{2}$ degrees and from $23\frac{1}{2}$ degrees to zero. It is twice zero in the year and also twice $23\frac{1}{2}$ degrees during the year, once north and once south.

To find the positions of stars we map out the sky by the same system of lines that we use on the surface of the earth in finding or locating places or points situated thereon. The terrestrial equator is taken as the initial curve. The plane of the terrestrial equator being produced to infinity, marks on the apparent dome of the heavens the position of the celestial equator or equinoctial, and this divides the heavens into two hemispheres, the same as with the earth. The equinoctial and the meridians of the sky are divided, like the terrestrial equator, into degrees, minutes and seconds. The zero, or starting point, of the equinoctial is the point of the vernal equinox. This division is based on the daily rotation of the earth on its axis, or on the apparent motion of the starry heavens in the contrary direction, the stars seem to us to move around the pole in the same direction as the sun does, namely, from east to west, at the rate of 15 degrees each hour. The space between these degrees grows smaller and the apparent motion slower as we approach the pole, which appears at rest. Polaris, or the pole star, being very near the pole, its motion is but slightly perceptible, and it appears to the eye as the steady point around which the whole heavenly vault turns.

By the orbital motion of the earth round the sun our position with respect to the stars is changed proportionately less than would be that of a grain of dust placed in the middle of the dome of St. Paul's, if it were made to whirl round in a circle having a diameter of 0.01 of an inch.

The stars really move in their orbits at the rate of 15 degrees an hour, if sidereal hours are employed. The sun would do the same thing were its axis not inclined to the plane of its orbit, but were perpendicular instead. When the sun is at either of the equinoxes (directly over the equator, twice in the year) it performs this feat according to sidereal time.

Although the speed of the earth's rotation is less as we recede from the equator and nothing at the poles, the stars near the pole move through the same number of degrees as do those on or near the equator, but since the distance between degrees is much greater in low latitudes, the stars near the equator must travel that much faster because they have that much farther to go. Just as a rotating wheel, a point on the tire moves faster than a point on the hub; but, notwithstanding this, when the point on the tire has completed a revolution, so has the point on the hub. As the circumference of the earth is about 25,000 miles, and the earth completes one rotation in 24 hours, it follows that a point on the equator moves at a speed of over 1,000 miles an hour, or through 15 degrees of longitude. The speed of rotation on the parallel of 60 degrees (which is just one-half of that of the equator) is about 500 miles in an hour, the space between the degrees being just half of what they are on the equator. On the parallel of 60 in one hour the earth rotates through the 15 degrees just the same, and this is true for any parallel. It is the space between the degrees that makes the difference.

As measured on the earth the distance around the orbit of Polaris is a little better than 360 nautical miles, since a degree of longitude on the parallel of 89 degrees is a trifle better than one nautical mile. Polaris completes this journey in 24 hours or with the rotation of the earth; in other words, Polaris has passed over the 360 degrees of the circumference. The star Dubhe is about 28 degrees from the pole or over the parallel of 62 degrees north latitude, and since a degree of longitude on this parallel is equal to 32.5 nautical miles, Dubhe must travel 11,700 miles to complete the circuit of its orbit in the 24 hours. Polaris and Dubhe pass over or through the same number of degrees of longitude, in the same length of time, but not through the same space. The space between the degrees of longitude on the equator is 60 nautical miles, on the parallel of 62 degrees 32.5 miles, and on the parallel of 89 degrees about one mile.

A parallel of latitude on the earth's surface equal to a star's declination is the same thing as that star's orbit of revolution round the pole; hence, a parallel of latitude and a parallel of declination are practically one and the same thing.

In the above diagram if we draw a line from the true pole to any given day on the outer circumference, where it cuts the ecliptic, indicates the position of the sun for that day. The outer circumference may be divided into the number of days of the year, or thereabouts. The sun's and any star's right ascension, both in time and degrees, may be found in the same manner, viz.: by drawing a line from the pole passing through the star to the outer circumference. With the sun a line drawn from the pole to the day of the month on the circumference will give it, though roughly.

The inhabitants of the equator behold both the northern and southern poles in the centers of their respective hemispheres, and all the stars of the heavens rise and set to them in the center of each daily rotation of the earth on its axis. At either terrestrial pole the corresponding celestial pole stands in the zenith, and one and the same hemisphere is always visible the whole year through.

On the equator, with a good clear water horizon, Polaris, when above the true pole, can be seen, but that is all.

Since the position of the imaginary pole remains unchanged the whole year through for every point of the earth, the shadow-pin of the sun dial is always directed to this point.

It will be seen from the foregoing diagram, and knowing that the earth rotates on its axis constantly, and at the same time is on its way around the sun and that not more nor less than one-half of the earth can be in the sun's light at a time, that the days and nights are always of equal length (12 hours) at the equator, but at all other places they are of unequal length, excepting when the earth is at the equinoxes.

In looking for different stars or for the various constellations or groups in the sky, it is best to begin with the Pole Star and Big Dipper. How to find the other useful navigational stars will be explained in another paper.

equinox, the mean sun will be 3m. 56.5s. behind it, or that many minutes and seconds east of your meridian, because mean solar hours are that much longer than sidereal hours, consequently it takes

hrs. 20 mins. it means that the vernal equinox is that number of hours and minutes from the mean sun, that is, ahead or west of it; or in other words, when you have the vernal equinox on your meridian, or when the sidereal clock shows oh. om. os., the sun is 2h. 20m. from your meridian, that is, east of your meridian.

Now, what about the position of the real sun during all this time? We know that the imaginary mean sun is supposed to keep as near the true sun as is consistent with perfect uniformity of motion, but it is sometimes before and sometimes behind the latter, the greatest difference amounting to rather more than a quarter of an hour. Since the true sun has a varying motion due to the obliquity of the ecliptic and the unequal motion of the earth in its orbit, the intervals between successive returns of the sun to the same meridian cannot be equal. For this same reason the vernal equinox and real sun do not separate from each other by the same amount at each rotation of the earth as do the vernal equinox and mean sun, but their difference is not much. Some days they separate at the rate of 3m. 30s. and other days as much as 4m. 25s. These are their extremes, the least and the most, so that between these times it is between those times. The mean or average of these times for one year will equal 24 hours or one day, the same as with the mean sun. The distance in time that the real sun is from the vernal equinox at any day is called the sun's apparent right ascension. The difference between the right ascension of the mean sun and the right ascension of the apparent sun is equal to the equation of time, the same as the difference between mean and apparent times, or the difference in time that the real sun is separated from the

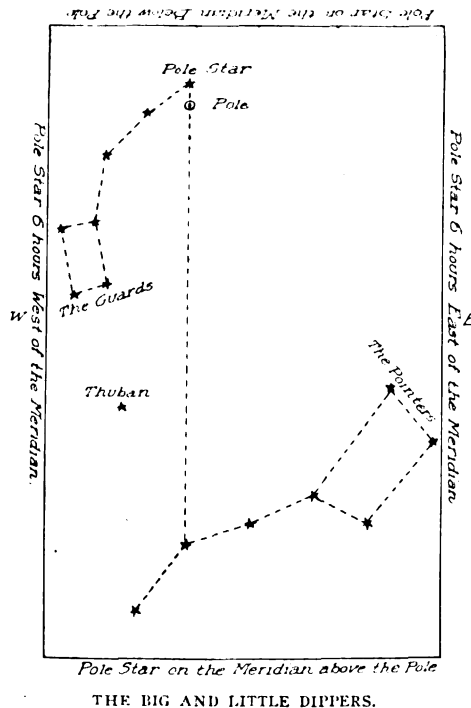
imaginary sun. Like the equation of time sometimes the right ascension of mean sun is ahead of the right ascension of the apparent sun, and then other times it is behind it.

Unlike the stars the right ascension of the sun is different each day owing to the variable motion of the earth in its orbit. The stars are such vast distances from the earth that these irregularities are unnoticeable, hence the reason that a star's right ascension, like its declination, is practically always the same. When we say that a star has a right ascension of 11 hours it means that the star in question will come to your meridian at 11 o'clock by sidereal time, not solar time, but sidereal time. Therefore right ascension of the meridian and sidereal time are one and the same thing when used with the stars.

Now, how would we determine the right ascension of any star if we did not have recourse to the Nautical Almanac, which contains all such data? We could do it this way: When any star is on the meridian, bearing either true north or true south of you, note the exact time by sidereal clock, and whatever the clock says is the right ascension of that particular star, so that any time thereafter it is necessary to know the time that this star will be on the meridian it will only be necessary to refer to this sidereal time. Now, the pole star, or Polaris, has a right ascension of 1h. 25m. 8s., so that when the sidereal clock shows 1h. 25m. 8s. Polaris will be on the meridian above the pole. The star Dubhe has a right ascension of 10h. 57m. 56s., so too, when the sidereal clock shows this hour Dubhe will be on the meridian above the pole, and just so with all the other stars.

Now, bear in mind that the sidereal day does not correspond to a definite hour of solar mean time, but in the course of a year runs through all the hours of the ordinary day by which the affairs of life are regulated. To test this roughly multiply 365 days by 4 minutes, and the result will be approximately 24 hours. Hence, 366 sidereal days are equal to 365 mean solar days. For confirmation of this, look in the Nautical Almanac for March, and you will find that the sun's right ascension is oh. om. os. when on the equator. The "Sidereal Time," in the last column of Page II for the month, would also be oh. om. os. were it not for mean time. Thence, onward, month by month, it steadily increases, until in September, when the sun is again crossing the line, but this time in the opposite direction, (the autumnal equinox) the "Sidereal Time" has grown to 12 hours, and continues to grow till it has attained the maximum of 24 hours in the following March.

The consequence is that those stars



that much longer to bring the mean sun back to your meridian. At the second rotation of the earth this mean sun will be twice 3m. 56.5s. behind the point in the vernal equinox, and so on by the same amount day after day, till the end of the sidereal year, when they are again together; thus the vernal equinox has gained a whole day on the mean sun. Now, this separation of the vernal equinox from that of the mean sun, is what is known as sidereal time or right ascension of mean sun. When we say that the right ascension of the mean sun is 2

which are now rising in the east, at any given hour of solar mean time, will be found setting in the west at the same hour six months hence; while those which at any hour are now setting, will, at the same hour six months hence, be found rising, and six months before or after it.

Now, though roughly speaking, the right ascensions of the stars do not vary in themselves, it has just been shown that owing to the stars coming so much earlier each evening, a given right ascension cannot be directly associated with any fixed hour of the day as indicated by a solar mean time clock or chronometer; and since sidereal chronometers or clocks are only to be found in observatories, and therefore, do not form a part of every vessel's navigating instruments, it becomes necessary in utilizing the right ascensions to make a trifling calculation, which, in its simplest form, is as follows:

There are two things that we must first learn, and that is, how to find the sidereal time at Greenwich corresponding to any given hour of mean time there, and secondly, how to find the sidereal time corresponding to any given hour at our own meridian. It is therefore obvious that if we can find the first and this is very easily found, we can as easily get the latter by applying the longitude of our meridian to it by converting the latter into time.

Since the sidereal day is a little shorter than its counterpart in a solar day, it becomes necessary in turning mean time into sidereal time to make some allowances. Table VIII, Bowditch, gives the allowances for changing sidereal to mean time, and table IX, for changing mean to sidereal. Similar tables are to be found in the 'Nautical Almanac, back part; Tables II and III.

The Nautical Almanac gives us the sidereal time at Greenwich noon for every day in the year, and it is found by mere inspection. Hence the rule for converting Greenwich mean time into Greenwich sidereal time is this: Add to Greenwich mean time the Greenwich sidereal time for the preceding noon, and the allowances given in Table III

Greenwich mean time.....	7h. 25m. 00s. p. m.
Sidereal time at Greenwich preceding noon	17h. 31m. 52s. p. m.
From Table III Nautical Almanac, corr. for 7h. 25m.	1m. 13s. p. m.
More than 25 hours (sub.)	24h. 58m. 05s.
Equals Sidereal time at Greenwich	24h. 00m. 00s.
	58m. 05s.

for the number of hours, minutes and seconds in the Greenwich mean time. If the sun is more than 24 hours, subtract 24 hours from it, because at the end of 24 hours sidereal time begins over again.

Example: Required Greenwich sidereal time when the Greenwich mean time as shown by the chronometer, was 7 hrs. 25 mins. p. m. on Dec. 15, 1903.

Now, what we want to know is how to find the sidereal time for the meridian we are on corresponding to any hour of mean time. The rule for finding sidereal time at ship or right ascension of the meridian, which is the same thing, when longitude is known, is this: Find the mean time at ship by applying your longitude turned into time to the time shown by chronometer, which always shows Greenwich time, provided it has been regulated to the time of that meridian. This performed add to mean time at ship the Greenwich sidereal time for the preceding noon and the allowance for Greenwich mean time by Table III of Nautical Almanac. If the result is over 24 hours, subtract 24 hours from it.

Example: Required the sidereal time at ship for Oct. 6, 1903, when the Greenwich mean time was 11hrs. 15min. p. m. Long. 85° W, equals 5 hrs. 40 mins., or right ascension of the meridian.

Greenwich mean time.....	11h. 15m. 00s.
Long. west (sub.).....	5 40
Mean time at ship.....	5 35
Sidereal time for preceding noon	12 55 53
Allowance for 11h. 15m. from Table III	1 51
Sidereal time at ship.....	18h. 32m. 44s.

Note.—We subtracted our longitude in time from Greenwich time, since the time at Greenwich is faster than any time west of it. When it is noon at Greenwich here on the lakes it is about 6 a. m. If the longitude had been east we would have added it to the Greenwich time, because the time in east longitude is in advance of the time at Greenwich.

Now, supposing we desired to find the sidereal time on board of a lake vessel, where it is unnecessary to keep a time piece regulated to Greenwich time. Turn your standard time as shown by your watch into mean time by allowing the correction for longitude, that is, the difference between your longitude and the longitude of the meridian your standard time is based upon. Having done this, turn your longitude into time and add it to your mean time and the answer will be the mean time at Greenwich for the same moment of your mean time at ship.

Example: On Lake Superior (near Whitefish Pt.) in Long. 85° W, at 9 p. m. central standard time, desire to know the time at Greenwich corresponding thereto:

Central Standard time.....	9h. 00m. 00s. p. m.
Corr. for Long. (diff. between 90° and 85° = 5° and 5° equals 20m), subtract	20m.
Mean time at ship for the longitude at	8h. 40m. p. m.

Longitude 85° equals 5h. 40m. (add)	5 40
Greenwich mean time.....	14h. 20m. p. m.
More than 12 hours subtract	12
	2h. 20m. a. m. of the following day.

Note.—Civil date (the date and time used in the business transactions of the world) commences at midnight and ends the following midnight, comprising two 12-hour intervals, one a. m., the other p. m.

Explanation of the foregoing example: We subtracted the correction of longitude of 20 minutes from the standard meridian, since a longitude east of the standard meridian has faster time than the time west of it; therefore, the time shown by watch being the mean time of the 90th meridian, must be slow of the actual time of the meridian on which the ship is located. We added the longitude of ship converted into time to the mean time at ship to get Greenwich time, because the meridian of Greenwich is east of us, and therefore has earlier time, or 8:40 p. m. at Greenwich had taken place 5 hours and 40 minutes before. Since the civil day begins at midnight and ends at midnight, 8:40 p. m. lacks 3 hours 20 minutes of a finished day, hence 5 hrs. 40 mins. added to it must bring it into 2 hrs. 20 mins. of the next day (a. m.).

Now, if we desired to get the sidereal time at ship in the above example we would proceed as already explained.

All this data is given in the Nautical Almanac for Greenwich noon, therefore, if the time at Greenwich is a. m. the sidereal time at Greenwich for the preceding noon will be taken out for the day before, but if the time at Greenwich is p. m., the preceding noon will be of the same date, as your date. See Astronomical Time.

The Right Ascensions and Declinations of all the stars available for the navigator are to be found in the back part of the Nautical Almanac, in the star tables. Those marked + are North, those — are South declinations.

The next thing to know is how to find out what star you can use at a particular hour. The rule is simple: We learned that the right ascension of the sun for any date or time is simply its distance in time from the point in the vernal equinox, and that the right ascension of any star is its sidereal time of passing the meridian, hence, its distance in time from this point in the vernal equinox. It must be plain then, that the difference between the sun's right ascension and the star's right ascension must be equal to our own solar time. Therefore, we get this rule:

To find the mean time of any star's passage over your meridian, subtract the sun's right ascension from that of the

star's right ascension. If the latter is the smaller, add 24 hours to it. The remainder will be the time of the star's meridian passage. If you use Page II of Nautical Almanac for the right ascension of mean sun (last column) the remainder will be mean time; but if Page I (always the left hand page) the remainder will be apparent time, and to get it into mean time the equation of time (taken from the same page) will have to be applied to it. Use Page II. for the day of the month your observation falls on. It is always the right hand page.

Example: In 1903 Polaris had a right ascension of 1h 23m 50s (in 1906 it is 1h 25m 8s), and on Dec. 1, 1903, the right ascension of mean sun for Greenwich noon was 16h 36m 40s. The R. A. (abbreviation for right ascension) of Polaris being less than the sun's R. A., we increase it by 24 hrs., equals 25h. 23m. 50s. and 16h. 36m. 40s. subtracted from it equals 8h. 47m. 10s. mean time.

To know which star will cross the meridian after a certain hour we have only to invert the above rule, or thus: Add that hour to the sun's right ascension. The sun will be the R. A. of your own meridian. If it is more than 24 hours, subtract 24 hours from it. The star table will then show you what star's right ascension is equal to or a little greater than your own. That will be the next star to cross your meridian. If you are sailing to the eastward it will cross a little ahead of time; if you are going west, it will be a little behind. Example: Mean time at ship 8h. 47m. p. m., sun's R. A. for above date and year, 16h. 36m. 40s.; the two added give a sum of 25h. 23m. 40s.; 24h. subtracted from it equals the R. A. of Polaris. If we did not know the R. A. of Polaris and looked into the star tables for a star with a R. A. of 1h. 23m. 40s. we would find that it belonged to Polaris. We have used Polaris merely for an example, but you can do the same thing with any other star. Bear in mind that here on the Lakes where we employ standard time that we must reduce it to its corresponding mean time before these examples will agree.

You will know whether the star is north or south of you by its declination. If you are in north latitude, the star will be south of you if its declination is north and less than your latitude. If its declination and your latitude are both north, and the former is the greater, the star will be north of you. The same principle applies if you are in south latitude.

A star with a declination equal to your own latitude and of the same name, will be directly overhead or in the zenith, when it is on your meridian. In our latitude Capella is such a star, it having a

declination of nearly 46° north. There are many stars that have practically the same right ascensions, therefore they come to the meridian along about the same time. Their declinations are, in most cases, widely different, and even opposite in name, hence, some will be low down in the horizon and others high up when they pass the meridian; some of them will bear north from you, others south. You can very easily tell when a star is approaching the meridian by its bearing.

Solely as a general reference the following stars of the Big Dipper have the following R. A's. and Declinations:

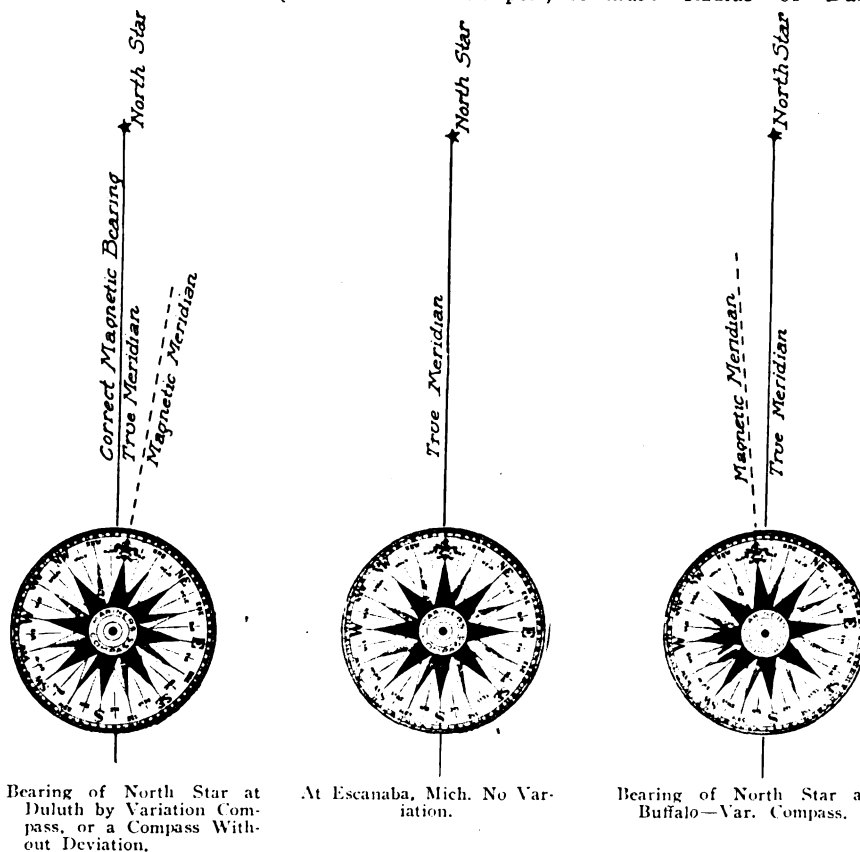
Dubhe	Dec.	62°	$16'$	N.	R.	A.	10h.	58m.
Phecda	Dec.	54°	$14'$	N.	R.	A.	11h.	49m.
Mizar	Dec.	55°		N.	R.	A.	13h.	25m.
Benetnasch	Dec.	49°	$48'$	N.	R.	A.	13h.	44m.

Since Dubhe has a Dec. of about 62° , its polar distance is therefore 28° ; in other words, this star appears to revolve around the true north pole of the heavens with a radius of 28° (of declination

subtract the latitude of your position, or the position used, from 90° . The remainder is called co-latitude, and mark it N. or S. the same as the name of the latitude. Then if the co-latitude and declination are of the same name add them; if of different names, subtract. The result is the approximate meridian height of the celestial body in question. The above example worked out according to this rule would be as follows:

Declination of Celestial Pole.....	90°
Latitude of place.....	62° N.
Co-Latitude	28° N.
Declination of Dubhe.....	62° N.
Meridian height of Dubhe (above the pole)	90°

Note.—Its meridian height when on the meridian below the pole under the above conditions would equal the diameter of its orbit minus its height above the pole, or thus: Radius of Dubhe



or celestial latitude). This is equal to saying that Dubhe's orbit or revolution is 28° . For a spectator situated on the parallel of 62° north, would have Dubhe in his zenith when it revolved to his meridian; in other words, if it were possible for this spectator to take no part in the earth's rotation, from that time, but could suspend himself in the air, he would have Dubhe in his zenith constantly.

To calculate the meridian height (altitude) of a star (or any celestial body)

equals 28° , therefore diameter is twice radius 28° or 56° , and $90^\circ - 60^\circ = 34^\circ$, its height when on the meridian below the pole. Hence, to calculate the meridian height below the pole, first calculate its height for above the pole and from it subtract the diameter of its orbit of revolution around the pole. By subtracting the polar distance from the latitude gives the same thing, thus: Lat. 62° ; polar distance 28° ; $62^\circ - 28^\circ = 34^\circ$. Polar distance is the distance in degrees of declination that a celestial body is from the

true pole of the heavens. Since this is the case the formula for finding the latitude from a meridian altitude below the pole will be polar distance plus altitude equals latitude.

The general formula for a meridian altitude is latitude equals zenith distance plus or minus declination. Zenith distance is the distance, measured in degrees, from the point precisely over the observer's head to the observed body. Let us suppose that we and the sun are both north of the equator. If now we can ascertain exactly how far we are north of the sun, and how far the sun is north of the equator, we will, by adding the two measurements together, know our latitude.

Zenith distance is the difference between the altitude of a celestial body and 90° . You know that it is 90° from the horizon to the zenith. Hence, having the altitude you have only to subtract it from 90° to find how far you are from the body in question. The following example should explain this:

In Lat. 44° N, what will be the altitude of Dubhe on the meridian above the pole; having determined the altitude find the latitude by the inverse process.

Declination of true pole.....	90°
Latitude	44° N.
Co-Latitude	46° N.
Dec. of Dubhe.....	62° N.
More than 90° subtract it.....	108
From	180
Altitude of Dubhe in latitude 44°	72°
Zenith	90°
Alt. of Dubhe.....	72° N.
Zenith distance	18° S.
Dec. of Dubhe.....	62° N.
Latitude	44° N.

Note.—Call the altitude north if the body bears north of you; then name zenith distance just opposite; when zenith distance and declination are of the same name add them, but when opposite names subtract them, the smaller from the greater. The latitude takes the name of the greater.

Astronomical Day.—The astronomical day begins at noon on the civil day of the same date. It also comprises twenty-four hours, but they are reckoned from 0 to 24, and run from the noon of one day to that of the next following. Astronomical time as well as civil time may be either apparent or mean, according as it is reckoned from apparent noon or from mean noon.

The civil day begins twelve hours before the astronomical day; therefore the first half of the civil day corresponds to the last half of the preceding astronomical day, and the last half of the civil day coincides with the first half of the astronomical day of the same date. Thus, January 9, 2 o'clock, a. m., civil time, is January 8, 14h, astronomical time; and January 9, 2 o'clock P. M., civil time, is also Janu-

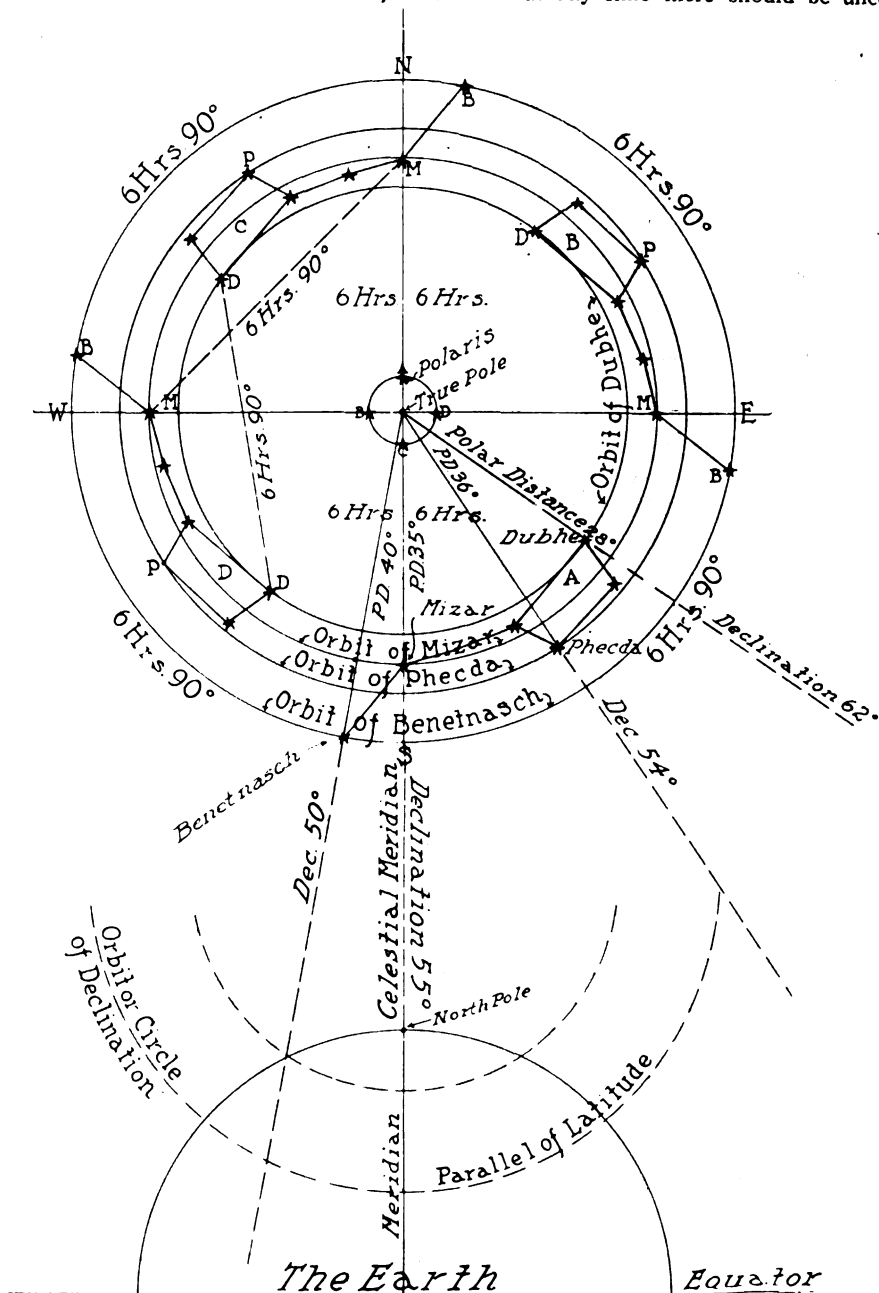
ary 9, 2h, astronomical time. Hence, we have the following rules:

To convert Civil Time into Astronomical Time.—If the civil time is marked A. M., take one from the day and add twelve to the hours, and the result will be the corresponding astronomical time; if the civil time is marked P. M., take

when west, add it to the local time, or when east, subtract it from the local time. The result will be the corresponding Greenwich time.

The data given in the Nautical Almanac for Greenwich noon is based upon astronomical time. Bear this in mind.

If at any time there should be uncer-



THE CELESTIAL CONCAVE.

away the designation P. M., and the astronomical time will result.

To convert Astronomical Time into Civil Time.—If the astronomical time is less than twelve hours, simply write P. M. after it. If greater than twelve hours, subtract twelve hours from it, mark the result A. M., and add one to the days. For example, October 3, 23 hours astronomical time, is October 4, 11 o'clock, A. M., civil time.

To find Greenwich Time.—Express the longitude from Greenwich in time, and

tainty concerning the Greenwich date, it may be determined as follows: Express the ship's time, that is, civil (mean) time, and proceed according to one of these two rules: If in west longitude, add the longitude in time to the ship's astronomical time; their sum, if less than 24 hours, will be the Greenwich time of the same date as at ship; but if their sum is greater than 24 hours, reject 24 hours, and put the Greenwich date one forward. But if in east longitude, the longitude in time is less than the ship's astronomical

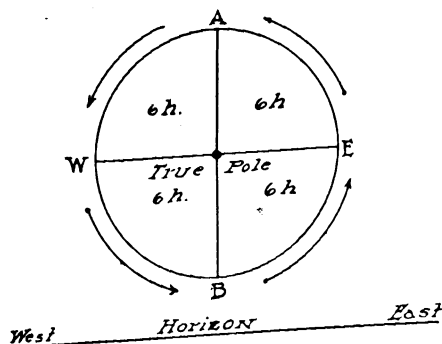
time, subtract the former from the latter, and call the Greenwich date the same as the ship's date; but if the longitude in time is greater than the ship's astronomical time, add 24 hours to the latter, then subtract, and call the Greenwich date one day less than the ship's date.

Hour angle or Meridian distance, as it is sometimes called, is another term that we need know. It may be defined as the angle at the Pole, included between the meridian of the observer and the celestial meridian of the body referred to. Like the right ascension, the hour angle is measured on the celestial equator in the same way that longitude is measured on the terrestrial equator. Hour angle may also be defined as the distance of a body east or west of the observer's meridian, expressed either in time or angle. Thus at 11 a. m. the sun's hour angle is 1 hour east of the meridian.

Since the sun revolves (apparently) around the earth once in 24 hours, passing through 15° of longitude every hour, if we can ascertain how many hours and minutes east or west of Greenwich the sun is, and how many hours and minutes east or west of the sun we are, we shall know our longitude. When the longitude is not known, then the problem is to find the hour angle of the sun.

At sea the chronometer always indicates Greenwich time, and that of course, is simply the hour angle there. If we can now find the hour angle at our own meridian, the difference between the two will be the number of hours, minutes and seconds we are east or west of the Greenwich meridian, and this quantity is, as we have seen, convertible into the degrees, minutes and seconds of longitude of arc.

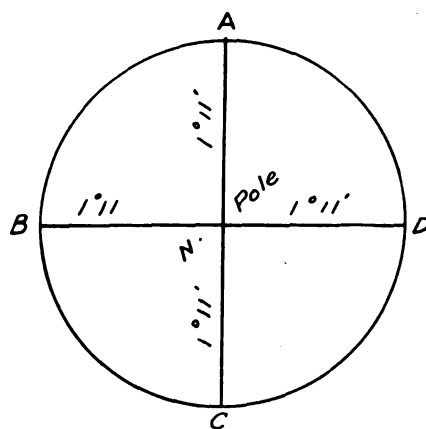
With respect to circumpolar stars it will be noticed that during the lower half of the star's journey their motion is from west to east. Attention is particularly called to this, because in observing star azimuths, unless acquainted with it, a beginner is likely to fancy he has made a mistake on discovering that, as his western hour angles grow larger after they have exceeded six hours, the star's bearing becomes more easterly, which at first sight seems opposed to what one would expect. The annexed diagram makes the explanation clear.



AWBE is the daily circle of a northern circumpolar star, and the line AB represents the meridian of the observer. At A the star is at its upper transit or in other words, it is on the meridian above the pole, and bears true north. During the following six hours, while traveling from A to W, it falls toward the westward; at W, therefore, the hour angle of the star is 6 hours west. During the next six hours, between W and B, it falls toward the eastward. At B it is at its lowest transit, or, in other words, it is on the meridian below the pole, and again bears true north. During the third six hours, between B and E, it rises toward the eastward; at E the star's hour angle may be expressed either at 18 hours west or six hours east of the meridian. And during the last six hours its course is upwards, and towards the westward, till, after a lapse of 24 sidereal hours, it again transits at A.

If the night be cloudless, it is easy in the northern hemisphere—without reference to the compass—to tell when a star is near the meridian below the pole, by its being vertically under the Pole star, which latter is now a trifle better than one degree from the true pole itself.

Now it is obvious that the hour angle of Polaris may be very great without any serious change in the altitude. Let the center of the circle be the true north pole of the heavens, and the circumference the apparent orbit of Polaris. At D and B the altitude of the star equals the altitude of the pole, which



equals the latitude. For the north pole being 90° from the equator, will be in the horizon of an observer at the equator. If you go 10° north of the equator, your northerly horizon will drop by 10° , and hence the pole will be 10° high, and so on up to 90° , when the pole would be over head, or 90° high. With the Pole star at A you would have to subtract $1^\circ 11'$ from its altitude to get the altitude of the pole, which equals the latitude; at C you would have to add $1^\circ 11'$. Now as the right ascension of the meridian advances from 0 to 24 hours in exactly the same time as the pole star appears to revolve around the

pole, the astronomers have made a table by which we can make the proper addition or subtraction to the latitude of Polaris at any hour.

The true meridian of a place is therefore approximately, if not actually, marked by a bearing of the North Star at any time, that is, the direction of the star from you at any place is the true meridian. The most that you can be out of the way is a trifle better than one degree.

To tell when the North Star is on the meridian can be performed roughly by means of a plumb line held out at arm's length. When the star Mizar (the second star from the end of the handle, or from Benetnasch) and the Pole Star are vertically in line as shown by the plumb line, Polaris is on the meridian above the pole, and therefore bears true north. The Big Dipper will be below the Pole Star as if resting on the end of its handle and the lower edge of its bottom next to where the handle joins the dipper part, indicated by the star Phecda. The position of the Pole Star is also indicated by the position of the Big Dipper. If the Dipper is east of the meridian the Pole star will be west of the meridian, and east of the meridian when the Pole Star is west.

The imaginary point representing the pole of the heavens may be found by drawing a line from Mizar to within a degree and a quarter of the North Star. These two stars are consequently on diametrically opposite sides of the Pole. When Mizar is six hours from the meridian, the North Star will be so also, and its altitude in that position will be nearly the same as the elevation of the pole. It will be known when this is the case by a line through Mizar and Polaris being parallel with the horizon. The eye can guess this pretty accurately.

Since the stars come to the meridian about 4 minutes earlier every night according to our time, we can, after once determining the time by watch that Polaris is on the meridian, find it at any time thereafter by subtracting 4 minutes from our time for every day elapsed from the date first noted.

When Polaris is on the meridian below the pole the star Spica is on the meridian above the pole. This indicates at once that Spica has a right ascension equal to the right ascension of Polaris, but on looking in the star tables we find that Polaris has a R. A. of 1h. 24m. and Spica's R. A. is 13h. 20m., about 12 hours difference. This is because Polaris has two R. A., one for its transit above the pole, the other for below the pole. When a sidereal clock shows 13h. 25m. Polaris will be on the meridian below the pole. Polaris has a declination of $88^\circ 49' N.$ while Spica has a declination of about $10\frac{1}{2}^\circ S.$ Hence, when Polaris is on the

meridian bearing north, Spica will be on the meridian bearing south, at least for our latitudes.

Polaris is approaching the pole (or rather the pole is approaching Polaris) at the rate of 10' yearly. due to precession. The precession is caused by the unequal attraction of the sun and moon on the equator, combined with the earth's rotation on its axis, and from the fact that the earth is not a true sphere.

Ship's Time at Sea.—The time shown by the ship's clock, which is set either to mean time or apparent time, usually the latter. This is roughly done by turning the hands of the clock to 12 (noon) when the sun crosses the meridian of the ship, or by allowing for the number of miles made in an actual east and west direction, that is, longitude, since the clock was last set. To accomplish this 4 minutes of time is added for every degree sailed east and 4 minutes subtracted for every degree sailed west since the clock was last set. Every degree of longitude equals 4 minutes in time, therefore, 1' of longitude equals 4 seconds of time.

A watch or clock could very easily be regulated to sidereal time, the same as it can be made to keep perfect mean time. The trouble would be that its face has only the 12 hour marks instead of 24. To set a sidereal clock could be performed roughly, as follows: When some well known star is on your meridian find its right ascension from the Almanac, and set your clock according to the star's R. A.

"Acceleration" and "retardation" are terms that need explaining. To reduce Mean to Sidereal Time—called acceleration. 1 day equals 3m. 56.58s.; 1 hour equals 9.8s.; 1 minute 16s. The correction for acceleration is always added.

To reduce Sidereal Time to Mean Time—called the retardation. 1 day equals 3m. 55.98s.; 1 hour, 9.8s.; 1 minute, 16s. The correction for retardation is always subtractive. To find the acceleration or retardation for any number of days, hours, or minutes, multiply the above numbers, the result will be the acceleration or retardation, as may be required. This should readily explain the contents of Tables II. and II. of Nautical Almanac. For all practical purposes 10 seconds allowed to the hour in either case will suffice.

Example: What is the sidereal time at Cleveland on Jan. 10, 1907, when the standard time (Eastern) clock shows 2:30 a. m.?

Meridian of Cleveland	81°	43'
Meridian of Eastern Time	75°	
Difference in Long. between the two meridians	6°	43'
Correction for Longitude	26m	52s
Standard Time	2 h.	30m. 00 a. m.
Correction for Longitude (sub.)	26	52

Mean Time at Cleveland	2h.	3m.	8 a. m.
Longitude of Cleveland expressed in time (add)	5	26	52
Mean Time at Greenwich	7	30	a. m.
Sidereal Time of preceding noon (Jan. 9) (add)	19	11	30
Acceleration, 7h. 30m. (add)		1	14
More than 24 hours	26	42	44
Subtract	24		

Sidereal time at Cleveland corresponding to 2.30 2h. 42m. 44s.

Note.—7:30 a. m. at Greenwich on Jan. 10 is 19h. 30m. astronomical time of Jan. 9. It is 19h. 30m. after noon of Jan. 9 or 4h. 30m. before noon of Jan. 10.

The sun is the greater time keeper of the world because it divides the day from the night. We know the ending and beginning of the day without looking at a clock for this very reason. If we used sidereal time instead of solar time the rising and setting of the sun would no longer herald the beginning of a new day nor the ending of that day; for this very reason sidereal time could not be used in the affairs of the business world.

AZIMUTH TABLES 'FOR THE GREAT LAKES.

Azimuth Tables for the Great Lakes by Frank Henrich, master mariner. This publication, now in the hands of the printer, will soon appear before the seafaring public. It is the first publication ever issued exclusively for use on those waters. It contains the fullest instructions concerning true bearings and their application on the ship's compasses. The most modern and important works on this subject in the United States and the principal foreign maritime countries were consulted, and no useful suggestion has been omitted to create an up-to-date and practical aid to the navigator in his frequent task of determining the compass error.

Owing to the unique arrangement of the tables, true bearings are obtained instantaneously. Numerous original auxiliaries accompanying the body of the work, which is augmented by maps and an abundant number of examples for practice, thus constituting a valuable assistant in self instruction.

HARBOR OF PORT STANLEY.

Harbor Master F. E. Shepard of Port Stanley, relates that the Dominion government is making the harbor of Port Stanley the best on the north shore of Lake Erie. There is 20 feet of water at entrance of piers now. A breakwater

is being built that will give full protection from south and westerly winds. The entrance is narrow—89 feet. No vessel over 325 ft. can at present wind in basin. There is fair room in the harbor for boats to tie up. As soon as the breakwater is finished the entrance will be dredged to a depth of 23 ft. below water level.

SUBMARINE SIGNAL NOTES.

Orders to equip E. H. Harriman's steam yacht *Sultana* have been received.

Capt. H. H. Crowell of the Metropolitan steamship *Herman Winter*, reports hearing submarine bell on Cornfield Lightship in a snow storm a distance of 7¼ miles, finding the direction within one-quarter point on the starboard side.

The bell on Gedney channel buoy was picked up and heard clear and distinct by third officer of *Carmania* a distance of 1½ miles; bell heard as soon as listened for.

Orders have been received to equip the steamship *Bay View* with the receiving apparatus.

Capt. Bond of the *Kershaw*, of the Merchant & Miners line, got the Fire island bell a distance of 6 miles in a snow storm.

During a heavy snow storm on March 8, Officer Hague of the White Star steamer *Baltic*, heard bell on Sandy Hook a distance of 9 miles when under a speed of sixteen knots.

Captain Coffin of the Commercial Tow Boat company's tug *Dudley Pray* reports that during a thick fog, with rain, he was able by the use of the submarine signal apparatus to locate the bell on Cornfield Point within one-half point on the starboard at a distance of 6 miles.

Work is progressing rapidly on the installation of Dutch lightships. The *Haaks* is about completed, the *Noord Hinder* will be finished early in April, and the *Terschellinger*, *Schouwenbank* and *Maas* light vessels will follow.

The S. S. *Majestic* of the White Star fleet, reports hearing submarine bell on Nantucket Shoals light-vessel 5½ miles in very misty weather, within one point on the starboard bow.

Installation of the submarine signal receiving apparatus has been made on the German cruiser *Munchen* and official trials are now being conducted.

Orders have been received to install the schooner *Myron D. Percy*, belonging to Percy & Small of Bath, Me.